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November 1981

Wallace, Floyd, Ellenzweig, Moore, Inc.
Griffith Associates

LAND USE MASTER PLAN STUDY

Logan International Airport

FINAL REPORT

Prepared for the
Massachusetts Port Authority

GOVERNMENT DOCUMENTS
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Foreword

The Logan Airport Master Plan is a management tool for use by Massport decision makers. During the preparation of the master plan, several factors indicated the need for prudence and greater precision in reaching future investment decisions for airport facilities. The current high cost of capital, an uncertain national economy and the present period of economic transition in the air transport industry have engendered considerable uncertainty about future airport facility needs. The planning approach described in this document provides a method by which a greater degree of accuracy about facility needs can be effectively incorporated into Massport's decisions for Logan Airport.

This is not a master plan in the traditional sense of the term; it does not provide a blueprint for the specific physical arrangement of airport facilities to be accomplished in accordance with a fixed staging schedule. While its ultimate purpose is to help clarify choices regarding airport facilities, such as roadways, parking and terminals, this planning document places great emphasis on the decision making process.

The Master Plan is a flexible decision making framework which will permit Massport to periodically refine and update facility choices in response to changing circumstances. It will help the Authority to respond accurately to unpredictable external factors which may affect airport activity levels at key facilities.

The main components of the framework are: (1) a system of land use zones which define a spatial pattern for the long-term development of the airport; (2) a planning review process which includes periodic monitoring of airport activity and congestion at major facilities in order to indicate when action should be taken to accommodate anticipated growth; and (3) a series of physical development options for individual facilities which can be changed periodically in accordance with the findings of the review process.

Probably the most important advantage of this approach to planning over that of a traditional master plan is its improved treatment of uncertainty. The planning review process allows the Authority to deal effectively with uncertainties in travel demand levels, government policies, and the future economic structure of the air carrier industry. The plan accomplishes this by establishing a framework which permits Massport to prepare adequately for the possibility of growth without prematurely committing expensive capital to major building programs. It is a framework which will help the Authority to avoid capital investment errors which might result in either seriously congested or underutilized facilities, and it will allow the Authority to plan for the airport's future with a greater degree of confidence.

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Summary

The Master Plan

A Non-Traditional Planning Process

The Logan Airport Land Use Master Plan is the product of a non-traditional planning process developed to address the particular needs of Logan Airport. The Plan provides the framework for future actions at Logan Airport and recommendations about what those actions should be. It has three components:

(1) A set of land use zones which delineate what long-range activities should occur in different parts of the airport (see Figure 3.3);

(2) A series of design options for the improvement or expansion of individual terminal, roadway, parking and service area facilities (Chapters 6-9); and

(3) A planning review process, including a facility threshold analysis, which will identify the passenger volumes which airport facilities can serve and indicate when action is needed to accommodate airport activities (Chapter 2).

The flexible and iterative planning process which has been created for Logan was designed to address the uncertainties affecting future airport needs identified during the inventory and analysis of the airport and its projected growth. Uncertainties about the airport's future stem from a variety of factors:

(1) Forecasts of future levels of passenger travel and cargo requirements are intrinsically uncertain and particularly difficult to predict at the present time.

(2) External factors such as the cost of capital, the national and international economies, and the policies of several levels of government all have effects on Logan which cannot be accurately predicted.

Facility Improvements and Development Packages

This Report includes a catalogue of options for improving individual terminal and roadway facilities and reorganizing service areas. Facility improvement options were developed to a conceptual level (1"=100'), and the interrelationships of all options were analyzed. Most facility improvements are relatively independent and can be undertaken separately within the context of the plan.

To illustrate the coordination of all options, two Development Packages differing in total investment level were developed for the terminal area (see Figures 3.4 and 3.5). The packages show the facilities required to handle the year 2000 forecast. The choice of options for these packages is based on evaluations presented for each in the main body of the report. However, the packages are not recommendations as such. Some other combination of options may be appropriate to future conditions and investment policies, and the structure of the plan provides this flexibility.

Plan Update and Review Process

A fixed Master Plan would be outdated almost as soon as it could be completed. Therefore, the plan update and review process which was devised accommodates changes in volume and shifts in location or types of traffic, and denotes the levels of activity which require new facilities. The foundation of the planning process is the regular monitoring of airport activities which is already being implemented by the Massport Planning Department. This monitoring will allow Massport to foresee the need for new or modified facilities with sufficient lead time for environmental assessment, planning and design, capital budgeting, and construction.

The plan update and review process is based upon a series of airport activity indicators which will be monitored on a regular basis. Capacity thresholds have been identified for airport facilities providing an approximate indication of th level of activity at which congestion will occur. By using these thresholds, the Authority can estimate when new facilities, or modifications in facilities will be required. The flow chart of the annual plan update and review cycle illustrates the sequence and content of the process (Figure 2.1).

Recommendations for Managing the Planning Process

- Community participation in the planning process, both short- and long-term, should occur throughout the proces and should not be limited to review of implementation-stage decisions. The community should participate in the annual planning review cycle.

- Monitoring of the airport should include both activity indicators and environmental indicators to insure that the needs of both airport users and the surrounding community are accommodated.

- Massport should remain flexible in its response to airport growth trends and should re-evaluate its investment and management objectives and strategies on an annual basis coincident with the budget cycle. The planning review process itself and the specific activity indicators which are monitored should also be reviewed and revised as necessary by the Authority every 3-5 years

- All growth analysis should be expressed in terms of base activity levels (1980 levels) rather than forecast year owing to uncertainties in predicting growth. However, continuous forecast updating is necessary to make judgements about lead times, approaching thresnolds and decision points.

Basic Findings: Facility Needs and Capacities

The planning process was completed for the airport based on inventory and analysis using 1979 and 1980 data. Overall analysis of airport capacity was made in terms of projected year 2000 activity needs.

For a location map of Logan Airport see Figure 1.2.

Projections provided as input to the Master Plan indicate that passenger volumes will reach 2.6 times the 1979 level by year 2000 and cargo tonnages 2.4 times the 1979 level, but that total aircraft operations will increase much less due to shifts in fleets to larger aircraft, denser seating, and somewhat higher load factors.

Based on an analysis of current activity indicators, present facilities and their thresholds, and the airport's market and community contexts, the following conclusions were drawn about Logan's capacities and needs:

- Increased ground access demands in relation to capacity will be the primary airport problem in the future, and only limited shifting of ground access modes is possible. Studies by the ground access consultant (CSI) indicate a maximum effort by Massport would be unlikely to accomplish more than a 20% shift from private autos to other transportation modes. Nonetheless, immediate action to encourage other modes should be taken such as provision of remote parking facilities, and enhancing the attractiveness of alternative modes including bus, subway and ferry.

- Land use zones to guide future development decisions have been developed based on environmental factors, optimum functional relationships and access considerations. The proposed zones can accommodate all forecast growth to the year 2000 level, although surface parking for some uses, e.g. car rental ready-cars, may need to be supplemented with garages. Although growth can be accommodated within existing airport boundaries, and some parcels can be returned to the community, acquisition of the Robie property would simplify construction staging and improve airport layout in the north service area.

- Improvements to Logan's internal roadway system are required in the near future. The improvements which are needed cover most of the airport, and specifically include: increased capacity and reduced waiting time at the main intersections of the Terminal and Service Roads, improved access to and from Route C-1 north of the airport, provision of an access road to Bird Island Flats (BIF) and through the SW Service Area, and increased curb space at the passenger terminals.

- Existing airside gate capacity at Logan is sufficient to handle forecast year 2000 domestic volumes, though an increase in gates will probably be needed for international carriers. Landside facilities including ticketing and lobby areas, baggage rooms and claim areas, curbs, and parking will need to be enlarged and improved at Volpe, North, and Southwest terminals.

- A visual and noise buffer between the community and the airport should be created wherever the two are adjacent. Building, landscape and urban design improvements to the airport should be designed to enhance this buffer. The land use zones mentioned above have been designed to help create and maintain this buffer.

- Landscaping, uniform signage, building design, and control of uses along the airport entry roadway are the most important issues in improving the overall appearance and functioning of the airport.

- Options for improvement of terminals and roadway facilities are to a great extent physically independent. Consequently, there is a great deal of flexibility in the timing and coordination of new or improved facilities.

Recommendations for Action

In addition to the airport-wide findings noted above, the planning process yielded a number of immediate recommendations for improvement of specific airport functional areas. These recommendations are briefly noted below according to three functional areas: terminal area, service areas, and community/airport interface. These are based on current (1980) forecasts and assessments of current volume/capacity conditions. The recent downturn in passenger volumes at Logan (-3% from 1979 to 1980) is an example of the type of fluctuation in growth trends that makes it necessary to update the forecasts annually and revise investment plans accordingly. MPA has begun to implement the monitoring process which is recommended in the Master Plan and will therefore be able to maintain the currency of the plan.

Terminal Area

a. Southwest Terminal: Short-term: widen upper curb area deck; connect in-terminal garage to Central Garage with vehicular bridge and/or parking decks.

b. South Terminal: Long-term only: may need to extend garage and possibly add three gates through extension toward Bird Island Flats.

c. North Terminal: Short-term: extend curb and entry area farther from central lobby on both levels (recognizing that this reduces convenience of internal circulation);

expand lobby facilities. Medium-term: make vehicular connections between curb and Central Garage.

d. Volpe Terminal: Short-term: add curb island, temporary customs facility, and parking. Medium-term: expand terminal lobby, curb, and gates in two or more stages, creating a U-shaped building surrounding a central parking structure; consider double-decked roadway to make terminal more usable by domestic carriers and to increase overall curb frontage.

e. Central Garage: Medium- to Long-term: expand to west or construct additional freestanding garage to supplement parking for North and Southwest Terminals and rental ready-cars.

f. Terminal Approach Road: Short-term: provide interim improvements to main intersection, and begin work to replace existing intersection with a grade separation, with north-south roadway on two-way overpass or, if agreement with the city and community is possible, on land under the existing highway ramps and adjacent to MBTA Blue Line Station.

g. Signing recommendations of the graphics consultant should be implemented immediately, recognizing that minor modifications will be necessary as the roadway improvements are implemented.

Service Areas

Southwest Area and Bird Island Flats:

a. Airmail Facility: long-term: relocate to location on airside of BIF access road. In short-term explore possible grade crossing of BIF access road by mail tugs (now in progress).

b. Present General Aviation areas: Short-term: develop to form building edge along Maverick Street with access from airport side only, and/or provide community buffer for car rental parking.

c. No change in other existing buildings, except minor expansions.

d. Remaining areas continue to be used for car rental firms.

e. Porter and Maverick Streets: Eliminate or restrict airport access and egress (subject to findings of current traffic analysis and consultation with city).

f. Bird Island Flats: Short- to long-term: to be developed as shown in the revised Final Environmental Impact Review (FEIR).

North Area:

a. Robie Airport Park: Long-term: acquire and integrate overall site plan if possible (recognizing that this raises sensitive issues regarding expansion of the airport boundary and has policy implications). If acquisition of entire area is infeasible, attempt to acquire right-of-way for 4-lane service roadway parallel to MBTA tracks.

b. Williams and PanAm Cargo Buildings: Mid- to long-term; redevelop as cargo.

c. AA Cargo and Hangar Sites: Mid- to long-term: expand passenger terminal facilities to these sites.

d. Delta and TWA Lease Areas: Basically unaffected, except possibly adjust taxiway alignment reducing excessive depth of these aprons slightly.

e. North-South Service Road Alignment: Short- to mid-term: improve alignment and width, and construct grade separated interchange at Neptune Road for better access to and from north.

Community/Airport Interface

a. Buffer Zone: Short-term: create a buffer zone between airport and community on all airport edges using both passive and active noise and visual barriers.

b. Off-Airport: Short-term: discourage new and existing airport-related uses in residential areas. This will require joint efforts of community, city and the Authority, with zoning change the first step. (A land use and zoning study is currently being conducted by a Massport consultant with community participation.)

c. Porter Street access: Short-term: resolve question of whether to close airport access/egress or merely to restrict access to some degree; this issue requires community discussion and a decision on its position, as well as completion of traffic studies. It is probably beneficial to the community in mid-term to close Porter, but some problems may occur in short-term, as existing traffic finds new routes.

d. Employee and Service Traffic: Short-term: improve Neptune Road/C-1 connection, and expedite the creation of the BIF Road to remove airport traffic from community streets. Potential design solutions identified in the Master Plan are now being evaluated as part of traffic studies of the Neptune Road/C-1 area.

e. Private Automobile Use: Short-term: Develop a long-range program of actions to discourage use of private automobiles by airport users, because increased traffic is the chief environmental problem which will impinge on the community in the future.

Staging of Actions

The recommendations described above have fiscal implications and must be placed within an overall sequence of events. The time horizon in which each action should be taken was identified above.

Many of the recommendations require construction or renovation of facilities, and therefore require direct capital expenditures by Massport. Two patterns of resource flow were explored as part of the planning process: Deferred and Early Investment. The resource flow pattern which defers expenditures offers the advantages of relative fiscal conservatism and also better allows repeated and incremental review of the environmental impacts of development decisions. The resource flow pattern which favors early investment requires larger financial commitments with each decision but will prove to be fiscally advantageous if financing becomes less expensive relative to inflation, or if construction costs escalate faster than revenues. Early Investment would also minimize the construction related disruption of the airport and may avoid environmental problems which could occur if ground access congestion is not alleviated in a timely manner.

Four different "staging strategies" are described in the Final Report. The staging strategies are combinations of Development Packages 1 and 2 with a deferred resource flow (A), and an early investment resource flow (B). The four staging strategies which result are designated 1A, 1B, 2A, and 2B and are discussed in Chapter 11.

Next Steps

The review of existing conditions at the airport, and the analysis of near-term forecasts has yielded a group of recommendations which the Authority should act on in the very near term. A number of them are already being pursued or are under discussion.

1. Improve the main intersection to reduce queue lengths and waiting time on the Terminal Roadway (currently underway, using options developed by traffic engineering consultants and the Massport staff).

2. Take action to insure adequate parking. This may include the provision of remote employee parking, exploration of lifting the current parking freeze, and detailed planning of short term parking improvements recommended in the Master Plan.

3. Give high priority to current work by the Aviation and Engineering Departments in the design of North Terminal

improvements, including increased curb space and enlargement of some airline terminal facilities.

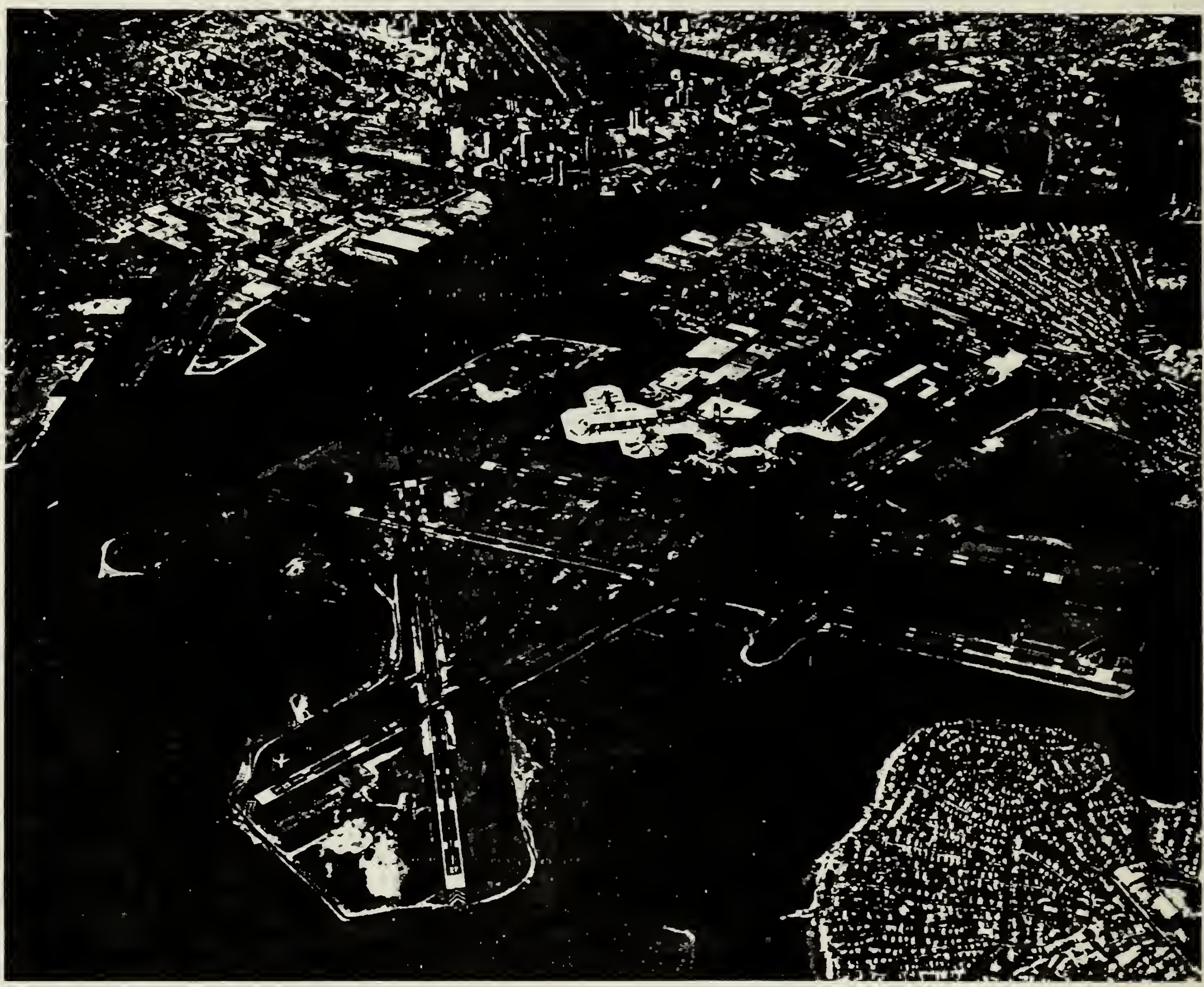
4. Provide increased curb, parking and customs area for Volpe on a short-term basis, prior to major medium- and long-term additions.

5. Develop a program to encourage multi-passenger vehicles, such as intercity bus service.

6. Make interim improvements to Neptune Road/C-1 access, and plan permanent improvements.

7. Take actions to implement the policy of assisting the relocation of environmentally offensive airport related uses from residential areas in conjunction with the findings of the East Boston land use study which is now underway.

8. In conjunction with interim roadway improvements, replace the existing airport signage system with the system recommended in the recent graphics study.



Aerial view of Logan Airport.

Credit: Aerial Photos of New England, Inc.

Chapter 1

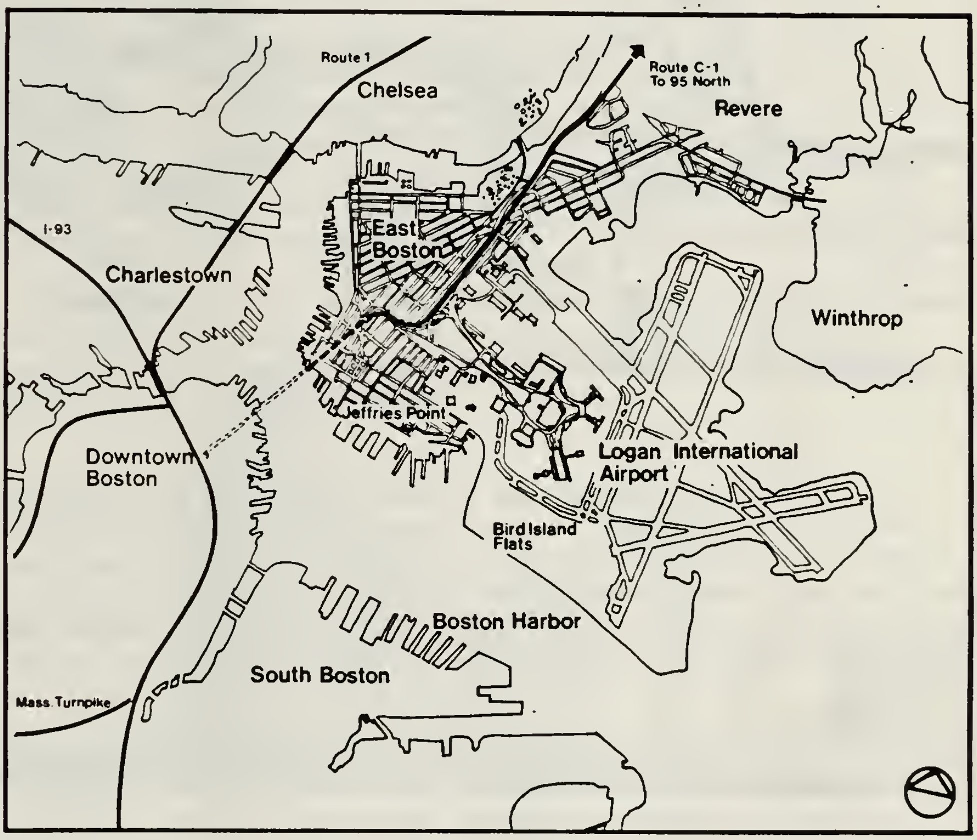
Introduction and Review of Year One

This report describes the final year of a two-year Logan Airport Land Use Master Plan study. The first year of the study concentrated on determining the proper location for air cargo and airline support facilities; it is documented in a June 1979 report to Massport, which is briefly reviewed below.

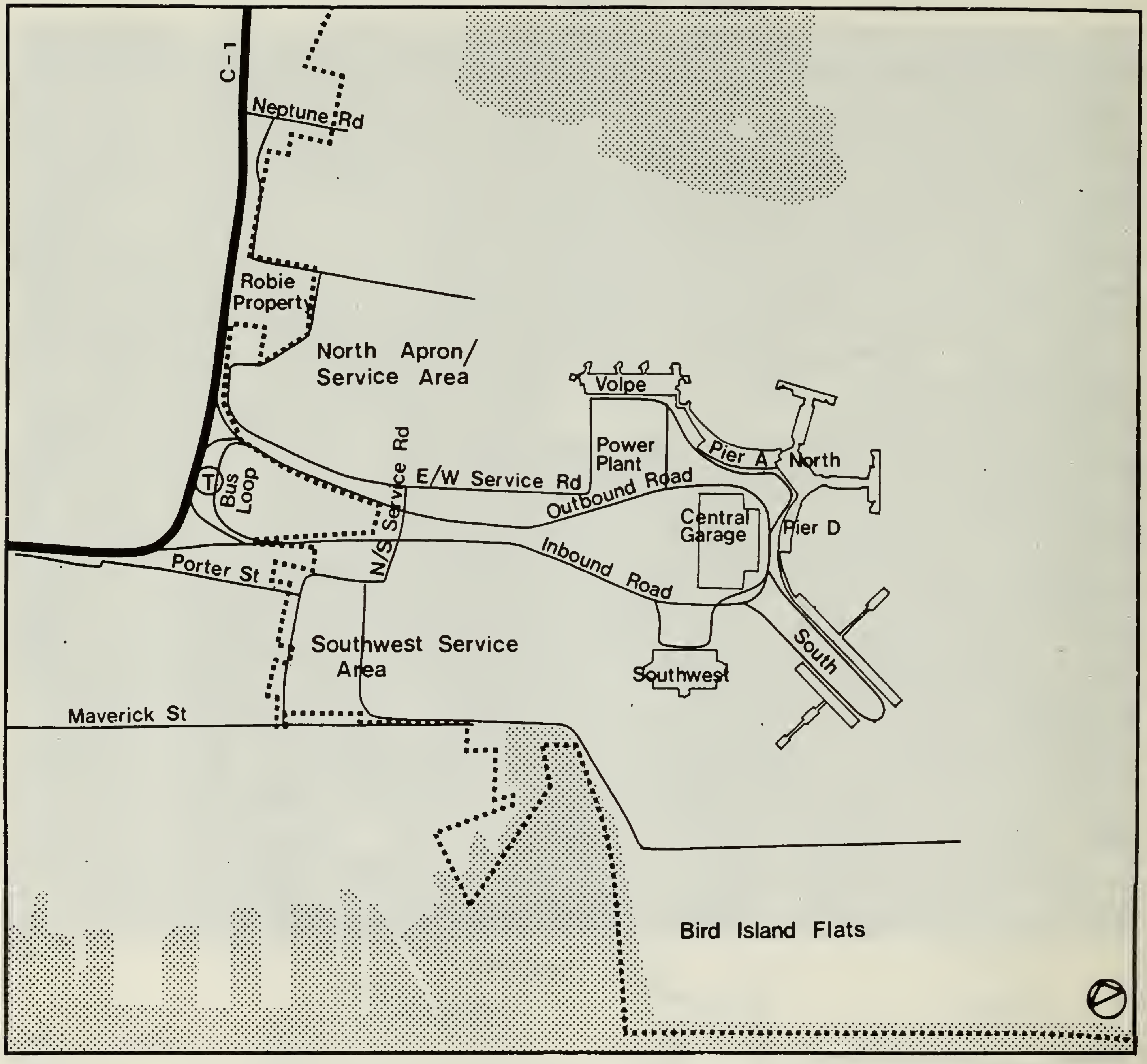
The second year of the study concentrated on terminal facilities and roadways, on the integration of the two years of work, and on the development of an ongoing planning process to keep the plan current.

Figure 1.1

Context



The Master Plan may result in a future airport layout like the development packages shown in Chapter 3 (Figures 3.4 and 3.5). Master plans are most easily and commonly illustrated as pictures of the area planned at some future date. However, it is worth emphasizing that the real product of the Master Plan study is not a recommendation to make the airport look like one of the development package options in the year 2000; rather, the plan provides:



Logan Airport

Figure 1.2

•••••••• Logan Airport Boundary

- An understanding of the relationships between activity and facility needs (Chapters 6-9);
- A system of zones to guide the location of new facilities (Chapter 3);
- A catalogue of options for facility improvements (Chapters 6-9);
- An understanding of how options can be fitted together and staged over time (Chapters 10 and 11); and
- A process for updating the above on an annual basis (Chapter 2).

Report Organization

This report begins with a section that deals with the airport in overview: planning review process, land use zones, urban design, and planning context. The second section of the report is organized around different types of facilities: terminals, parking, roadways, and cargo and support facilities. Each of these chapters discusses existing conditions and options for future action. The final section of the report covers development strategies: coordination of projects and staging improvements over time.

The report is already lengthy. Nonetheless, a great amount of material needed for technical completeness has been omitted; this material appears in the Appendices which are bound in a separate volume.

Review of Year One Planning Studies

The work of the first year of the Logan Airport Land Use Master Plan study comprised general inventory, analysis, and planning concepts for the future with emphasis on air cargo and support facilities and a development plan for the Bird Island Flats (BIF) landfill area. This work remains valid and is the foundation for the Year Two work presented in this report.

Inventory and Analysis The inventory relied heavily on available data. Idealized functional relationships were studied, and the resulting concepts provided a framework for the study. The airport landside was conceptualized as an interface between airfield and regional highways, with separate circulation systems for passenger-related and service-related traffic and with a buffer zone along the community edge.

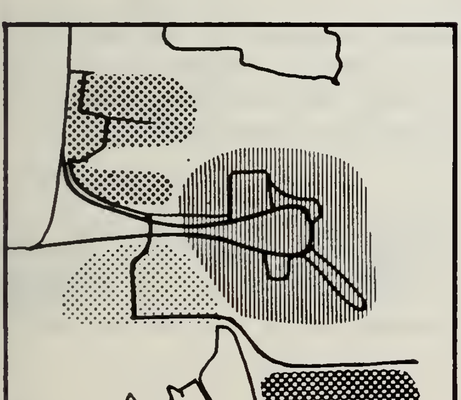


Figure 1.3

Concept A

The analyses of the potential of airport sub-areas for new development and of urban design characteristics remain valid. Lease termination data have been updated (See Figure 3.2). Community-oriented objectives remain valid: providing a buffer zone, relocating general aviation, and separating truck access from neighborhood streets. The survey of off-airport land uses has been updated and

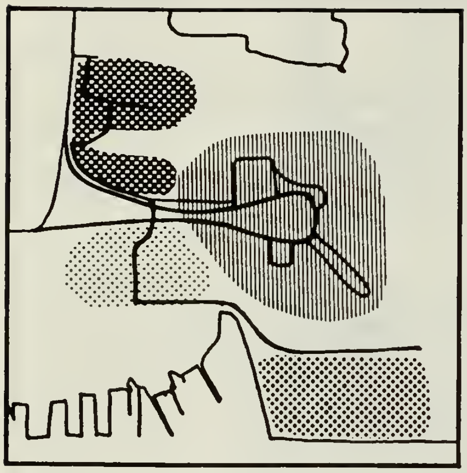


Figure 1.4
Concept B

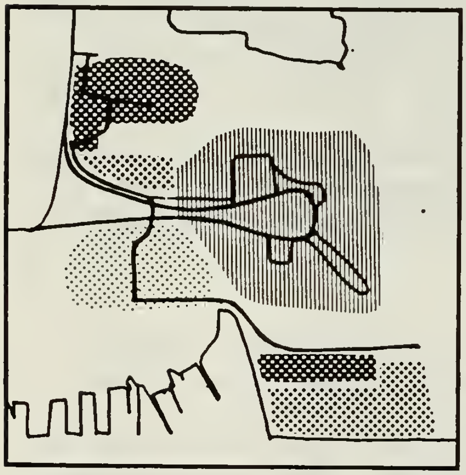


Figure 1.5
Concept C

▥ Passenger Terminals

▒ Air Cargo Facilities

▓ Airline Support Facilities

░ Southwest Service Area

expanded and the issues surrounding the relocation of airport-related uses from inappropriate locations has been elaborated (See Chapter 4 and Appendix).

Air cargo forecasts and the analysis of cargo building utilization remain valid. The standardized layout and space requirements for hangars and for air cargo, food preparation and car rental facilities have been updated. (See Chapter 9).

Concept Plans Three concept plans were prepared, differing in the allocation of air cargo and airline support facilities between Bird Island Flats and the North Apron. These concept plans also contained common assumptions regarding roadway and facility improvements in other parts of the airport.

Massport selected Concept Plan C as the basis for BIF development. This concept plan located both air cargo and support facilities in both the North Apron and BIF areas with each airlines' facilities in the area closest to its passenger terminal gates. Alternative BIF layouts were developed in the Year One Report and later elaborated by the consultant along with buffer area studies following Year One.

The final development plan for BIF is substantially similar in layout to Alternative C-1 in the Year One Report, although the concentration of cargo facilities is greater and airport-related mixed-use development has been included. The evaluation of concept plans in the Year One report gave emphasis to noise from taxiing aircraft. Truck noise is also a significant source and in Year Two the design concepts emphasize buffers along roadways. Surveys done since Year One indicate a much lower level of truck traffic to cargo facilities than earlier estimated.

Passenger forecasts were unavailable in Year One, and virtually all of the work on passenger terminals has been done during Year Two. The Year Two roadway studies are based on concepts developed during Year One, although the options presented in this report have been developed considerably beyond those concepts.

The conceptual layout for the Southwest Service Area has remained substantially as shown in Year One. The possibility of future acquisition of Robie Industrial Park is presently uncertain and is no longer being assumed as a given.

Chapter 2 Recommended Planning Process

Logan Airport, like other airports, is now going through a a period of change which makes the traditional master planning approach inappropriate. Massport is confronting several major uncertainties that make future needs difficult to assess: the worldwide demand for air transport, as energy costs rise; the Boston hub area's economy, now one of the healthier ones in the Northeastern United States; the effect of deregulation on scheduled service to Boston by international, major domestic, minor, and commuter carriers; the capacity of ground access facilities across Boston Harbor; the availability of federal funding for airport improvements, which has been interrupted for fiscal 1982; and the availability and cost of capital funds to public authorities and to airlines. In general, air transportation is a mature industry whose future development needs must be carefully considered.

The traditional master planning approach uses forecasts to provide a "program" or shopping list of facilities needed in a future year: x gates, y parking spaces, z square feet of cargo building. The master plan then offers a design solution, in the form of a plan view of the airport, which arranges the programmed facilities in a rational manner.

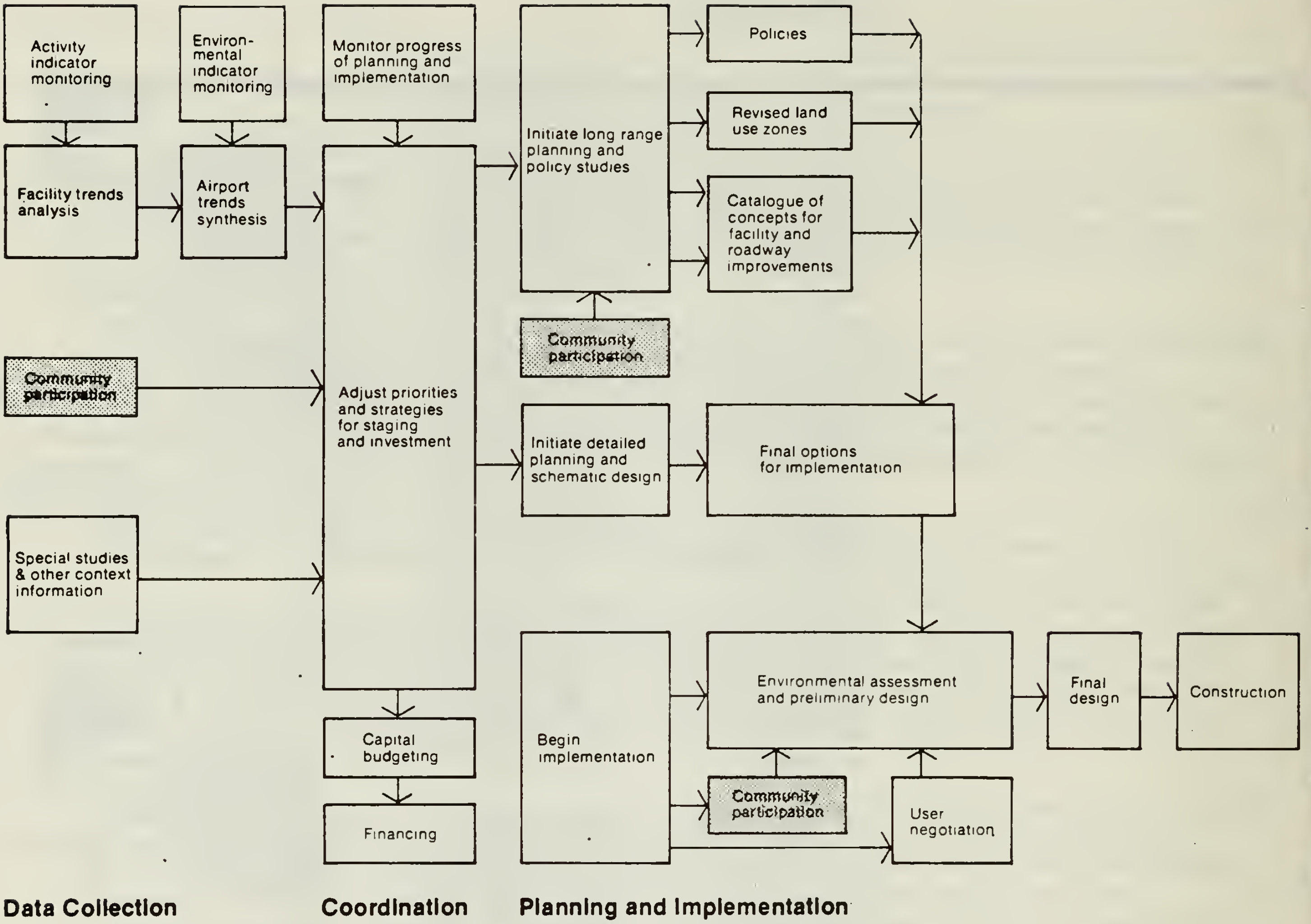
The uncertainties mentioned above, however, make it difficult to establish not only the amount of growth by the design year but also the basic concepts that will be appropriate to airport planning in the future. There is a high risk that a traditional 20 year plan will become rapidly obsolete.

A Non-Traditional Master Plan

The plan proposed in this report consists of three elements: a physical framework of land use zones to guide the location of future facilities, a system of organized planning information, and a process for updating and reviewing this information on a regular basis. The spatial and physical elements of the plan are described in the following chapter. The planning process is described below.

Annual Planning Review Cycle

Planning for change at Logan Airport, whether for an increase in traffic, a shift in carrier markets or changes in government regulations, requires the interaction of many different actors and the coordination of many airport components. Because of the complexity of the airport system and the large capital investments which many changes require, a lengthy lead-time is often a necessary prerequisite to change. In addition, short term problems tend to dominate the agenda that decision makers must address.


Activity indicator monitoring
Environmental indicator monitoring
Monitor progress of planning and implementation
Initiate long range planning and policy studies
Policies
Revised land use zones
Catalogue of concepts for facility and roadway improvements
Facility trends analysis
Airport trends synthesis
Community participation
Community participation
Adjust priorities and strategies for staging and investment
Initiate detailed planning and schematic design
Final options for implementation
Special studies & other context information
Begin implementation
Environmental assessment and preliminary design
Final design
Construction
Capital budgeting
Financing
Community participation
User negotiation
Data Collection
Coordination
Planning and Implementation

Annual Planning Review Cycle Figure 2.1

The problem with the traditional planning/forecasting approach is two-fold. First, the projections are inherently uncertain and therefore may lead an airport to over- or under-build particular facilities. Second, airport use patterns and functions, such as the proportion of business travel to leisure travel, the number of long-haul vs. short-haul trips, the use of the airport for business (e.g., conferences held at airport hotels), or the amount of cargo shipped through the airport change over time. Projections made at a fixed point in time cannot account for those shifts although airport facilities must accommodate those changes. Experience has shown that a plan based on a single set of projections is often out of date within a few years. This is particularly true given the currently unsettled state of the airport industry.

The planning process which is recommended for Logan as an integral part of the master plan is an annual planning cycle which reviews changes at the airport and sets the stage for short-, mid-, and long-range actions in relation to capacity or service level thresholds. This process makes annual adjustments or corrections to an organized stock of information that provides the basis for decision making. (Some types of information need not be updated every year, for example, special studies on air transport industry trends.)

The planning review cycle can be looked at in either of two ways: the cycle can be seen as a process which updates a system of information on a regular basis, or it can be seen as a system of documented information which receives a regular update. One view emphasizes the activity which Massport staff would be engaged in; the other view emphasizes the products of this activity. One can look at the process either way, but the distinction is worth keeping in mind to clarify the material in this chapter. Figure 2.1 illustrates the process and its products.

North Terminal curb.

The annual planning process begins with an update of activity indicators. Specific activities (such as numbers of passengers, aircraft movements, and number of vehicles parked at the garages) are monitered and as they approach a threshold where improvements are required, solutions are explored. The timing of actions varies with the problem being addressed. For example, baggage handling capacity can usually be adjusted by an individual airline within 1 to 2 years, therefore long lead times do not have to be built into the planning for single airline baggage handling. Roadway capacities are dependent on major and expensive infrastructure, therefore changes must be contemplated many years before they are needed.

An annual examination of data on present and projected use relative to the thresholds established in this planning study will allow Massport to learn about and act on the needs of the airport. As particular parts of the airport

Table 2.1

COMPONENTS OF THE ANNUAL PLANNING REVIEW CYCLE

Issue*	Indicator	Source of Data
Overall growth forecast	- Total passenger volume	Green sheets
Parking and roadway use volumes	- Total passenger volume	Green sheets
Overall terminal facilities use	- Total Passenger volume	Green sheet
Gate requirements	- Total aircraft operations	OAG Chrono list
Curb requirements	- Total aircraft operations	OAG Chrono list
Terminal facility requirements	- Carrier aircraft operations	OAG Chrono list
Peak hour operations for each carrier and each terminal	- Carrier aircraft operations	OAG Chrono list
Operations in all hours for SW, S and N Terminals**	- Carrier aircraft operations	OAG Chrono list
Operations in all hours for Volpe Terminal	- Carrier aircraft operations	OAG Chrono list
Cargo apron and building needs	- Monthly cargo tonnage by carrier - Scheduled cargo operations by hour, carrier and aircraft type	Green sheets OAG Chrono list
Roadway adequacy	- Entering vehicle by hour for each entrance	Automatic traffic counter
Cross-harbor access	- Sumner tunnel volumes by hour	Mass. Turnpike Authority
Bus and limousine ridership**	- Number of passengers	Survey of Operators***
Parking garage saturation	- Record of attendance by hour and day of week	Parking garage attendants
Staging of improvements	- Lease and sublease termination dates	MPA files
Aircraft load factors to more precisely determine airport facility thresholds (Peak hour only)**	- Passenger volumes at peak hours	Industry publications, CAB Data
Baggage facility requirements**	- Baggage per passenger	Survey of passengers
Curb and roadway requirements**	- Vehicles per passenger	Survey of passengers

* All observations should be made in peak month (August) unless otherwise noted.

** Information need be updated only every 3-5 years.

*** Provided under an operating agreement data provision requirement approach their thresholds for change, Massport will be aware of the impending requirements and will not be faced with sudden, urgent needs and inadequate lead time. The planning cycle approach will allow appropriately scaled and integrated response to changing conditions.

The planning cycle reveals areas where existing facilities are approaching saturation. The saturation, or threshold, point is identified in this report for a number of components of the terminal system (e.g. curb and baggage claim area). Other facilities, such as air cargo buildings are more flexible in their capacities but can be monitored by inspection or through discussion with users.

Figure 2.2

Steps Leading to Facility Improvements

STEPS LEADING TO FACILITY IMPROVEMENTS

1. Planning review process identifies approaching capacity threshold. Potential mid-range actions are shifted to short-range consideration.

2. Design alternatives developed to schematic level.

   Time required: 1/2 to one year, including work scope, consultant selection and evaluation.

3. Preliminary evaluation of alternatives:

   o Functional characteristics, addition to capacity
   o Impact on carriers and other airport users
   o Relationship to other future projects
   o Community impact
   o Costs, revenues generated

   Time required: included in above.

4. Entry of potential cost to capital budgeting cycle.

5. Environmental assessment.

   Time required: 1/2 to one year.

6. Detailed engineering/design and construction documents.

   Time required: 1/2 to 1½ years.

7. Construction.

   Time required: 1 to 3 years.

Total time elapsed: 2½ to 6½ years.

Data Collection and Analysis

The planning review cycle has three major functions. First, the annual review of specific activity indicators will yield data on the upcoming thresholds of particular parts of the airport (e.g., baggage handling space for one airline or curb space at one terminal). These findings can then be used to indicate when planning and negotiation for specific airport components should be initiated.

The second function of the annual planning review cycle is to identify overall activity trends at the airport (e.g., a growth in international rather than domestic traffic, a shift in arrival mode from private autos to public transit or an increase in the number of passengers per aircraft). The identification of general trends will be used in long-term airport planning and will help to set priorities and determine when major facility related actions should begin. Special studies by industry analysts should be commissioned from time to time to review and supplement the identified trends. Environmental trends should also be documented and analyzed.

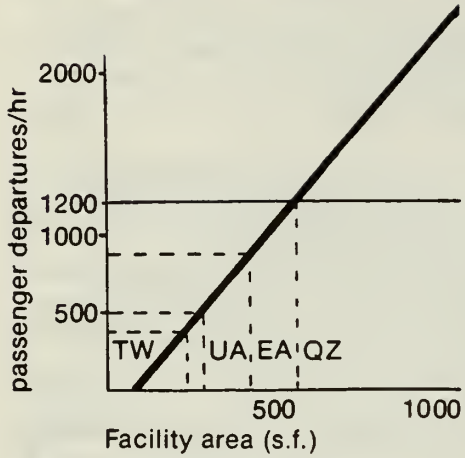


Figure 2.3

Illustration of Space/ Activity Threshold for Several Airline Baggage Sorting Areas, including Hypothetical Airline QZ

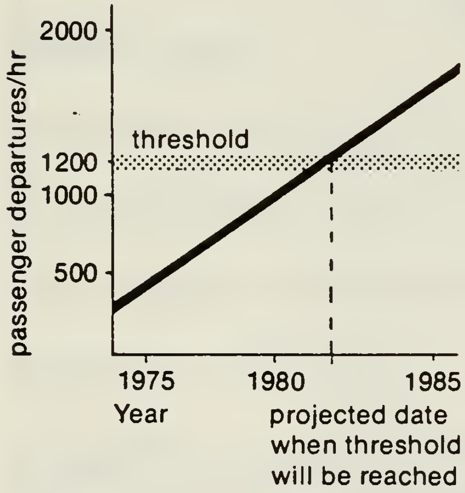


Figure 2.4

Trend Line Analysis for Hypothetical Airline QZ

The third major function of the cycle is to achieve an open process of decision making which provides for input from the community and airport users before the project implementation stage.

The first step in the annual planning review cycle is the compilation of Activity Indicator Data. These data can be used to determine whether a facility is approaching a use threshold. The indicators which make up the data base for the planning cycle are listed below, along with the problems they can help to address and data sources.

A "threshold" relates the amount of space available in a facility to the amount of activity that it can handle without undue inconvenience. Thresholds imply standards of convenience which reflect industry standards for planning new facilities. Figure 2.3 illustrates such thresholds for the baggage facilities of several airlines.

The concept of a "threshold" beyond which service suddenly becomes inadequate is clearly an oversimplification of a relatively complicated volume-delay relationship. However, it is a useful concept for planning as long as the actual situation is kept in mind. The threshold for curb space, for example, depends on the average automobile dwell time at the curb, and capacity can be increased by policing to shorten dwell times. This kind of management response can be substituted for capital improvements such as providing more curb length, but the flexibility of the facility to handle more growth or peak volumes is thereby reduced and the quality of service may be worsened.

The next step in the process is to take the information gleaned from the activity indicators and update the Facility Trends Analysis. These updated trends consist of a series of activity data for successive years, e.g. aircraft departures in the peak hour of an average August day (Figure 2.4). The trend shown by these data will indicate whether any thresholds are being approached. The specific findings are useful by themselves and also in combination with other facility activity trends and general observations of airport functions.

These data may indicate that one or two functions in a terminal are approaching the general range of facility saturation, while others have enough room. This technique will allow Massport to forsee which facilities will need amelioration in the short term and which will not. Facility operators may be aware of an approaching problem but may not be forthcoming in time to allow adequate lead time to solve it, or may not be able to tell from observation alone where the real problem lies. One example of such a situation might be a problem with curb congestion. From observation alone it may not be possible to tell whether the cause of the congestion is inadequate curb space or long check-in times which would increase layover time at the curb. The activity indicators would help to determine which of these terminal components was actually overloaded.

The Facility Activity Trends analysis will be used in two ways: first to update the Facility Threshold Dates and second to generate Airport Trends. The updating of threshold dates is a fairly straightforward process whereby a new point is added to the existing data base (see Figure 2.4) and the trend line for the data is adjusted if necessary to give the best fit. This trend line is extrapolated to where it exceeds the facility threshold; the projected threshold date can be directly determined from the graph. Standard projection techniques can be easily accomplished graphically or with a pocket calculator.

The generation of overall airport trends involves an analysis of general changes in volumes or patterns of airport use. The airport trends will be identified by combining the individual facility trends in passenger volumes and aircraft operations. When overall passenger volumes are examined they will indicate whether there are shifts in air traffic between terminals and whether there are shifts in daily or annual peaks. This information is needed for long-range terminal and roadway planning.

Forecast Years Versus Real Years

The analysis of terminal thresholds attempts to avoid relying implicitly on forecasting by using activity levels as a frame of reference. In Chapter 6, peak-hour thresholds for facilities such as lobby and curb are expressed as a percentage of August 1980 scheduled activity. These thresholds can and should be adjusted annually by checking individual airline schedules and by spot-checking load factors, percentage of transfers, vehicles using the curb and parking facilities, and other relevant factors.

Planning for future investment, however, must discuss actions in real time, since many projects require substantial lead times for planning, environmental assessment, design, and construction. The lead times must be measured in years, regardless of whether the growth towards a generalized capacity threshold during that lead time is faster or slower than expected.

The relationship between thresholds and project lead times is illustrated in Figure 2.5, which shows several options, described in Chapter 6, for improving the capacity of the North Terminal departure curb. Both management and capital improvements are possible ways to put off the date when service levels become unacceptable. In some cases, capacity may be increased but not enough to offset the growth that occurs while the project is being implemented.

Some issues are too complex to be handled routinely or do not require annual attention, for example, ground access mode split or percentage of originating versus transfer passengers for each airline. Special studies can be scheduled as necessary to address these issues.

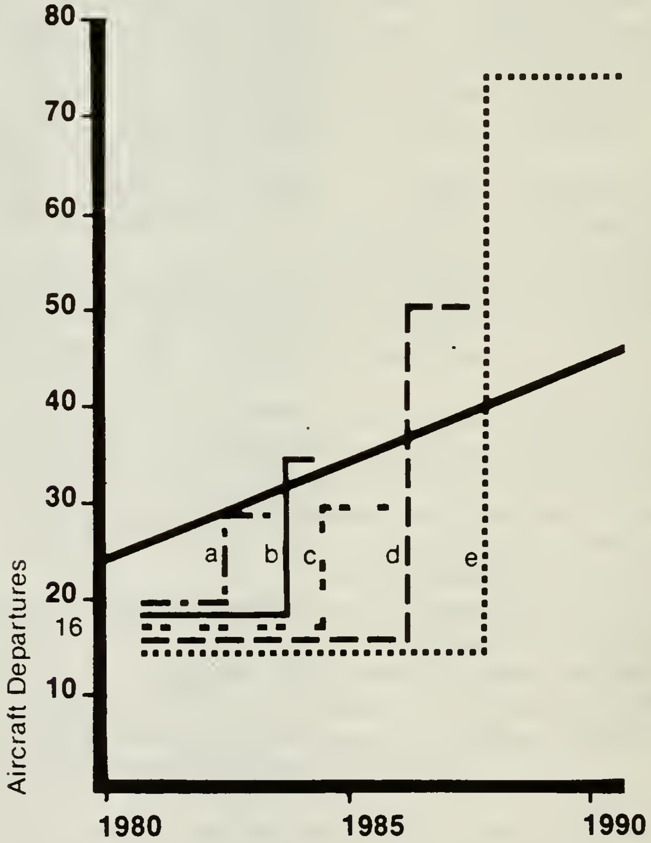


Figure 2.5

Relationship of Thresholds to Project Lead Times for North Terminal Departure Curb

- a. Police curb
- b. North Terminal option 1
- c. Police curb, reduce auto use
- d. North Terminal option 2
- e. North Terminal option 3

Coordination of Improvements

The airport threshold analysis provides input to the coordination phase in which on-airport and off-airport factors are synthesized and priorities are set. The findings of the facility activity trends are used to update the status of each facility and then to address each facility with the appropriate type of action: short-range implementation program, mid-range planning preparatory to implementation, or long-range planning. The coordination phase also includes monitoring of on-going projects. Initiation of medium-range planning studies is called for at a point when the lead time for the most lengthy option to improve a given facility begins to approach the available time remaining before the threshold for that facility. Similarly, before mid-range planning studies can focus on a particular facility, the background provided by long-range planning should be available. The present report contains both long-range conceptual planning and focussed mid-range planning for selected facilities for which implementation of improvements should begin soon.

The coordination phase of the annual planning cycle also includes input and revision to staging and investment strategies and to the capital budget cycle for short-term studies and projects. The relationship between the airport planning cycle and Massport's capital budgeting cycle is described below.

If an open planning process is to be achieved, the community should be involved in the annual coordination phase.

Planning and Implementation

Facility improvements and management initiatives to address airport problems will move through three planning horizons as thresholds are approached. For example, several design concepts for increasing the number of gates at South Terminal already exist. In five years it may emerge as an issue to be dealt with ten years hence. During that ten years, the potential improvements must be brought from the planning concept stage through focussed planning studies to define options in greater detail and then through the implementation phase, which includes environmental assessment, design, and construction. If the option with the longest lead time is expected to take six years to implement, detailed planning studies to develop options should commence perhaps eight years before the threshold is projected to be reached.

Long-range planning should include periodic revision of Massport policies and of land use zones (which are locational policies described in Chapter 3). Conceptual planning for facility improvements and management studies should also be undertaken from time to time. These studies generate options for future consideration and provide a framework for detailed planning and preliminary engineering. This work need not occur annually but rather as part of less frequent master plan updates or as new problems and trends emerge from the annual planning review. Community participation is advisable at this stage as well as in environmental review during the implementation period.

The knowledge gained from general planning studies is also useful in foreseeing upcoming airport needs or conflicts between different uses. If a number of major facilities will need upgrading at roughly the same time, the capital budget and investment strategy must take this into account. Likewise, the staging of improvements may require some actions to be taken earlier or later than their individual thresholds would have indicated; five years advance warning that this staging may need to happen can ease the growth pressures of the airport and help to alleviate acute construction or management bottlenecks.

Each of the components for which indicators will be studied has a number of options for change which could be pursued when the facility approaches its threshold. The lead times for different options vary greatly. For example, the roadway alternatives which have been studied have lead times ranging from two years to six years. As the threshold year for a particular component approaches, the longest lead time for the known options for improving that component, Massport must decide whether to begin planning for that option or to forego it and pursue options with shorter lead times which may be acted on later. This decision will be based on a number of things including the effectiveness of the solution, its cost, and its environmental impacts. In addition, if some of the more modest solutions are pursued, the ramifications of choosing the short-range solution on the long-range problem must be considered. A modest, short-range roadway solution may make a long-range solution more difficult in the future. Figure 2.5 illustrates the relationships of different options and their lead times.

Facilities whose improvement lead times are thresholds within 2 to 3 years of the projected period remaining until thresholds are reached should be considered to be within the detailed planning horizon. During this period, detailed planning and preliminary engineering studies will be performed, resulting in well-defined alternatives for environmental assessment and capital budgeting.

The implementation horizon includes those facilities which are within the critical lead times identified for their improvement. An implementation program for capital improvements has three main steps: 1) Environmental Review, which may take eight months to two years or more, depending on the issues involved; 2) Final Design, which may take six months to two years; and 3) Construction, which may take a few months to three years, depending on the size and complexity of the project and the difficulty of staging. Ongoing throughout this phase is community participation, negotiation with airport users, capital budget review, and the securing of financing.

The final step in the annual planning review process is to review and evaluate the process itself. The list of indicators may need to be adjusted, new components of the airport may need to be added to the process or components that are presently included may become irrelevant. Updating the process is as important as updating the information each year.

Massport Budget Process

A planning process parallel to the proposed airport planning cycle occurs at Massport every year. A five-year capital budget is developed each year, with a new fiscal year five years hence added each year and priorities and estimates from past capital budgets adjusted and revised. This five-year system has now been in operation for about three years.

The budget is determined in an incremental manner from the bottom up. Unit managers present proposed budgets to their department heads; the department heads assimilate all unit managers' budgets and develop department budgets. Priorities within the departments are established by the department heads in consultation with unit managers and other department employees.

The budgets from each of the departments are then submitted to the Massport Budget Department. The Budget Department reviews the proposed budgets with the departments in comparison with the previous year's budget estimates and prepares a preliminary budget for review by the Finance Committee of the Board of Directors. The Authority's Executive Director reviews the preliminary budget and works with the Finance Committee and the Budget Department to prepare a final budget. The final budget must be approved by the Board of Directors. Department heads and other Massport staff may be asked to participate in any level of budget decisions. The prioritization of the items on the overall Massport budget is worked out by the Budget Department, the Executive Director, and the Finance Committee of the Board.

For many years, Massport's revenues were sufficient both to meet all of its obligations and to provide money for new capital investments. In fiscal year 1981 and the years to follow, however, desired capital expenditures exceed projected revenues. Priorities must be set among the major projects which Massport Departments hope to undertake, and careful budget planning must resolve the differences between desired investments, available revenues and prudent borrowing.

Recently, changes have been proposed in the federal lending and grant policies toward large airports. If these changes are carried through, Massport's federal airport funds would be reduced or eliminated. Under the legislation currently being debated, user fees could be levied by the airport, but exactly how much money could be raised, and the impacts of user fees on the total air travel industry are not yet known.

Massport's revenues and expenditures are determined in large part by the Authority's Enabling Act. The following description is taken from A Study Guide to Massport Financials.

> "Massport does not receive State tax monies nor can it pledge the State's credit. It must raise its monies from its own operations, from the sale of revenue bonds and from the return on its investments. The Trust Agreement sets forth stringent requirements that Massport must meet before it can turn to the bond market. These requirements include the establishment of a series of funds to insure sound financial management of Massport's operations and measures to protect the investments of the financial community.
>
> "Each of the funds are legally separate entities and can only be used for specific expenditures. For example there is a fund for new construction, a separate fund for facility maintenance, and still another fund for maritime activities. There are a total of sixteen funds - each having specific purposes.
>
> "The Trust Agreement directs the flow of monies into and out of Massport through the funds. Revenues coming into Massport, in order of priority, are assigned to operating expenses; to servicing the debt and then to the maintenance of facilities. Remaining monies either go towards reducing the debt to lessen the future debt service requirements (bond redemption), or toward new and needed projects (improvements). The Trust Agreement, therefore, defines how Massport's revenues are to be distributed through the system.
>
> "The requirements for each fund are stringent and must be accounted for on a monthly basis. Each month's revenues are alloted, by an established formula, to specific funds. If certain financial conditions are met, as predetermined by the Trust Agreement, then Massport can issue new bonds to raise money for new projects without risking the investments of other bondholders."

Certain constraints on borrowing money are written into Massport's Enabling Act. "Massport's net revenues (including the maintenance budget) must be in excess of 25% of the maximum debt service." This constraint on borrowing has implications for the capital budget and therefore for the staging of airport improvements.

Planning for the future at the airport must fit within the Massport-wide budgetary process. This is of particular importance because many of the improvements needed at the airport will require major capital expenditures. The planning review cycle which is proposed for the airport will allow significant input to be made to the budget process regarding expenditures which will not be required for several years. Within the Aviation Department, priorities will be set among the different improvements, but the long-range flexibility of the planning process can help to set the priorities of the Aviation Department within the overall Massport budget. The two planning streams should be integrated, with the annual planning review cycle being completed in time to provide input to the budget process.

Chapter 3

Land Use Zones and Development Packages

Existing Land Use Pattern

Logan Airport can be divided into three major areas within which there are different types of land use and access to and from landside and airside facilities. Existing land uses at Logan Airport are shown in Figure 3.1.

The passenger terminal area wraps around a central roadway loop, this arrangement maximizes apron frontage (it also limits curb frontage). Public parking is concentrated in the terminal area. The Southwest Service Area contains car rental facilities oriented to the main roadway; and air cargo buildings, the air mail facility, food preparation and general aviation facilities, and a hangar, all oriented to the south taxiway. This taxiway will end at the Eastern Airlines hangar in the near future. The North Apron area presently contains the airport's largest concentration of cargo facilities and hangars. To the north of Prescott Street is a mixed use area of fuel farms, hangar, food preparation, airport maintenance, and other facilities as well as the surviving houses of the Neptune Road neighborhood. This area plus the North Apron makes up what is called the North Service Area in this report. This portion of the airport lies partly in the clear zone of runway 15R/33L. The other major areas of the airport are the airfield, which is being studied in a separate planning element not covered in this report, and Bird Island Flats (BIF), currently being developed for air cargo and other airport related uses.

Airport land uses gradually change over time. One indicator of an area's ripeness for change is the status of its current ground leases (see Figure 3.2). Outside the terminal buildings, most leases at Logan are for a site area which is improved and developed by the tenant. Lease terms are generally 25 years for undeveloped sites, allowing the investment in improvements to be amortized; buildings revert to Massport at the end of the lease period. Massport can terminate leases if necessary, but avoids doing so because of settlement costs and loss of good will with tenants. Many buildings at Logan are subleased by the lessee.

Land Use Zones

A system of land use zones is proposed to guide Massport decisions about the location of various types of airport land use (see Figure 3.3). This system is analogous to a city zoning map in that it is a means of achieving a rational pattern of land use without specifying in advance exactly how every parcel of land should be developed. In the case of Logan, the problem is simpler than in local zoning because Massport controls all of the airport land; however, the uncertainty of future facility needs calls for a similar kind of flexiblity.

Table 3.1 Land Use Zones, Access and Potential Uses

Zone	Access Type	Potenital Uses
Terminal	Taxiway Main roadway loop Airside service road	Passenger terminal Public parking General Aviation
Apron	Taxiway Service roadway Airside service road	Air cargo Hangar General Aviation Fuel Farm Food preparation Airport maintenance
Airside	Service roadway Airside service road	Air cargo (excl. all-freight) Freight forwarder Food preparation Fuel farm
Landside	Service roadway	Freight forwarder Car rental storage Employee parking Remote public parking Food preparation Office Hotel
Central	Main roadway loop	Public parking Car rental ready car/Check-in Hotel Bus/limo/taxi layover Subterminal
Multiple use	Characteristics of any two of the above	Uses of either adjacent zone

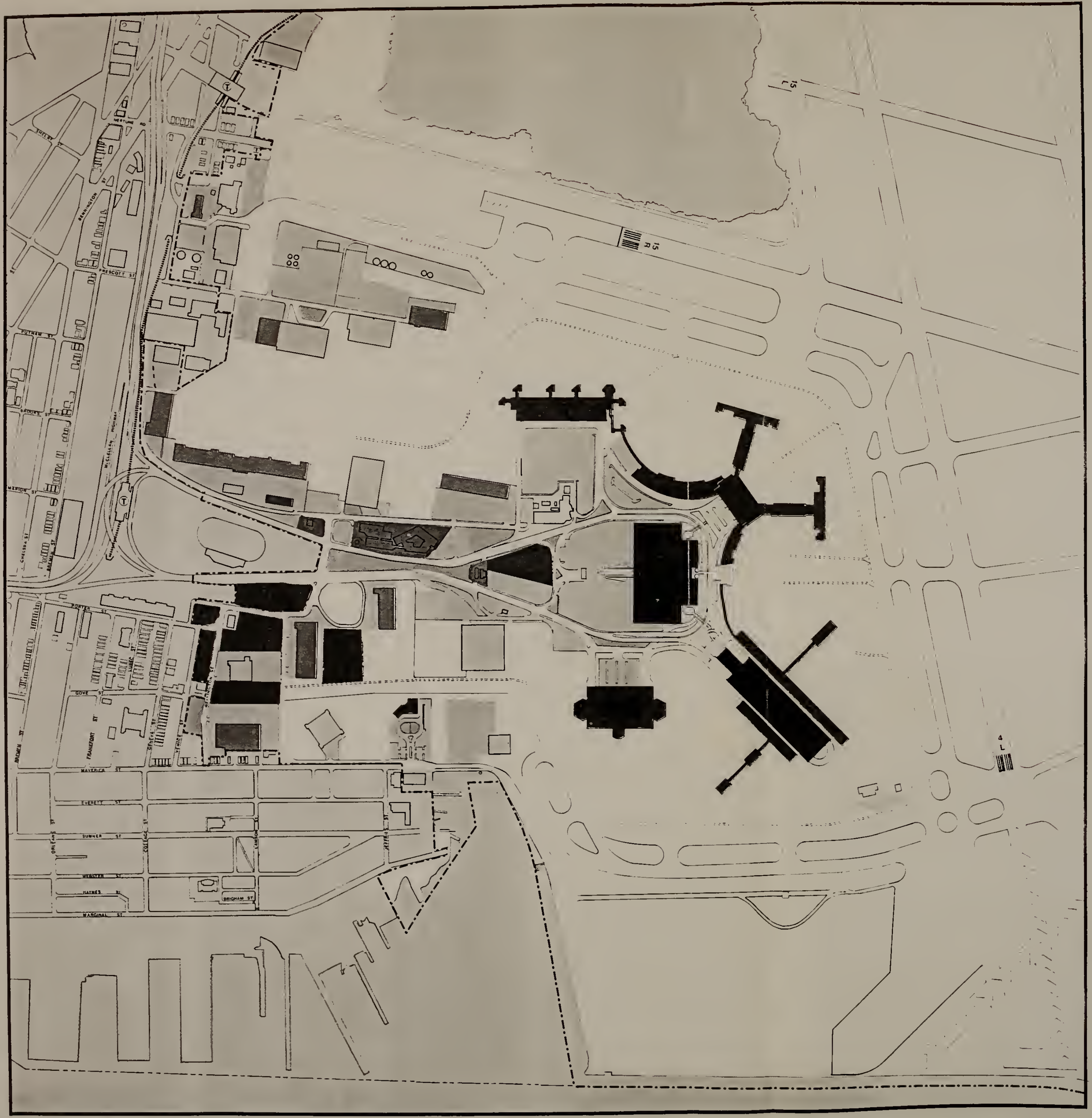


Figure 3.1

Existing Land Use

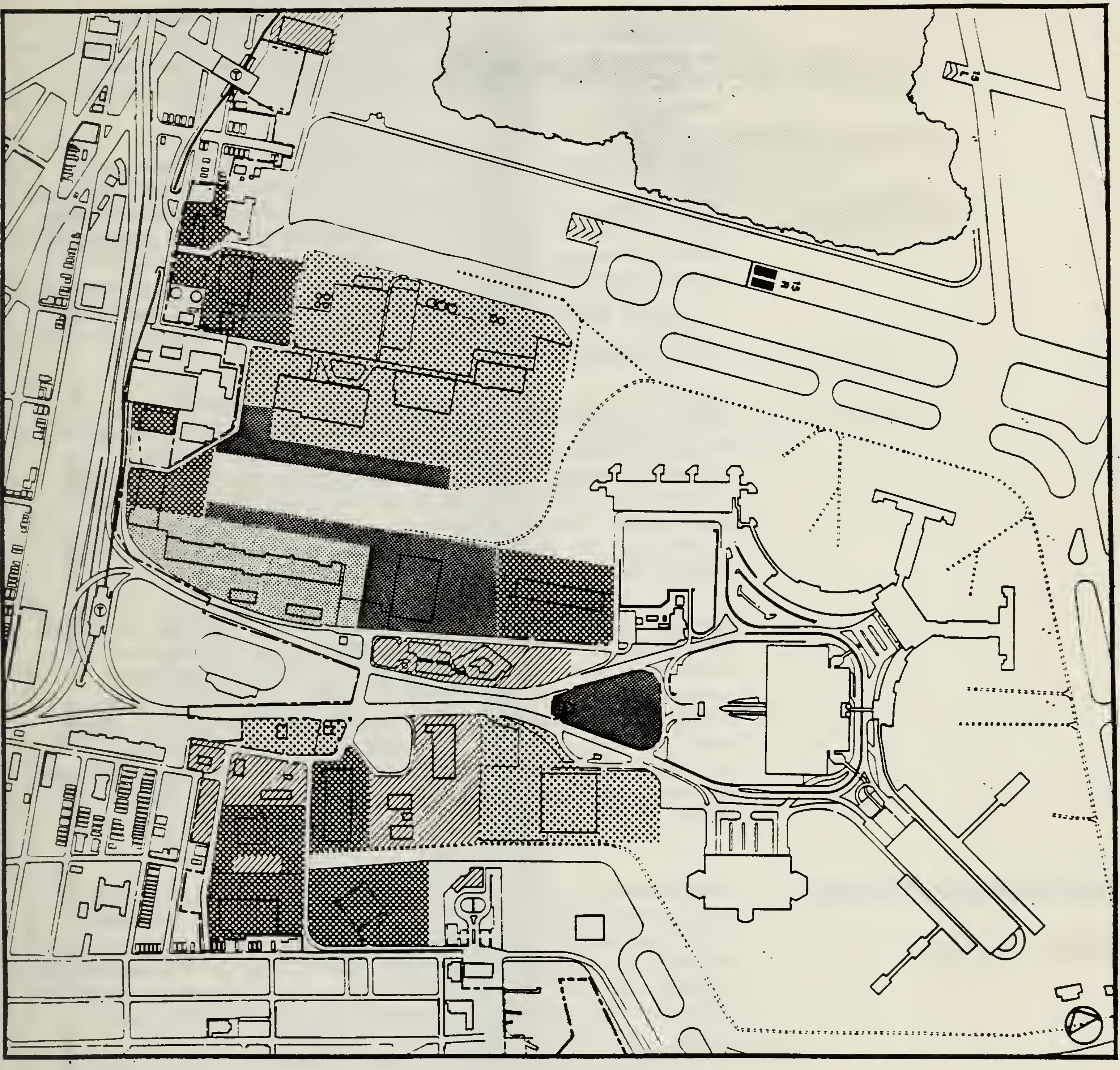
-·-·-·- Airport Boundary
■ Terminals
▨ Passenger Service Facilities
□ Airline Support Facilities
▨ Cargo and Mail Facilities
□ Airport Support Facilities
□ At Grade Parking
■ Rental Car Areas
■ Garages
□ Landscaped Areas

0 500 1000 feet 2000

Logan Land Use Master Plan
Massachusetts Port Authority

Wallace, Floyd, Ellenzweig, Moore, Inc./Griffith Associates
Architects/Planners

November 1981



Lease Termination Dates **Figure 3.2**

- ■ At Will
- ░ 1981-1984
- ░ 1985-1989
- ▨ 1990-1994
- ▩ 1995 +

The land use zone system is based on environmental considerations, access, and the amount of land expected to be needed for each type of land use by the year 2000, assuming a continued high rate of growth (4.5% per year in passenger volumes).

Land requirements were based on a "Year 2000 Program" derived from forecasts developed for Massport and modified by its staff (see Appendix). This analysis revealed that all forecasted uses can be accommodated in the appropriate zones, although parking structures may be required to accommodate all the automobiles which have been projected. It is not certain that all of the growth which has been projected will occur, but if it does, the land use zones can accommodate all of it.

Environmental considerations dictate that airside uses which involve taxiing aircraft be kept as far as possible from the residential neighborhoods adjacent to the airport. Major service roadways carrying truck traffic should also be separated from the community by buffering land uses. These considerations are based on the objectives of minimizing aircraft and truck noise, and visual impacts of the airport on surrounding areas.

Access is the major criterion used to define the land use zones within the overall framework of environmental considerations. The relationships between the zones, their access to airside and landside facilities, and their associated potential uses are shown in Table 3.1. There are four major types of access: taxiway access for aircraft, airside vehicular access, landside service road access, and access from the main roadway loop which connects the terminals with the highway.

Development Packages

Development of the land use zones can occur in a variety of ways which are responsive to future needs and resources. Two development packages accommodating some portion of the activity projected for the year 2000 have been prepared to illustrate how the facility options, described in Chapters 6 through 9, might be combined into consistent airport-wide plans. In order to illustrate different levels of investment, only Package 2 resolves all facility-related problems associated with the year 2000 design volumes. Package 1 assumes a lower level of investment. The packages are shown in Figures 3.4 and 3.5.

In each package, Bird Island Flats is assumed to be developed according to the site plan in the BIF Final Environmental Impact Report: a combination of air cargo, general aviation, and office development.

Consistent with their purpose as illustrations, the packages are not evaluated as wholes; their component parts are evaluated in Chapters 6-9.

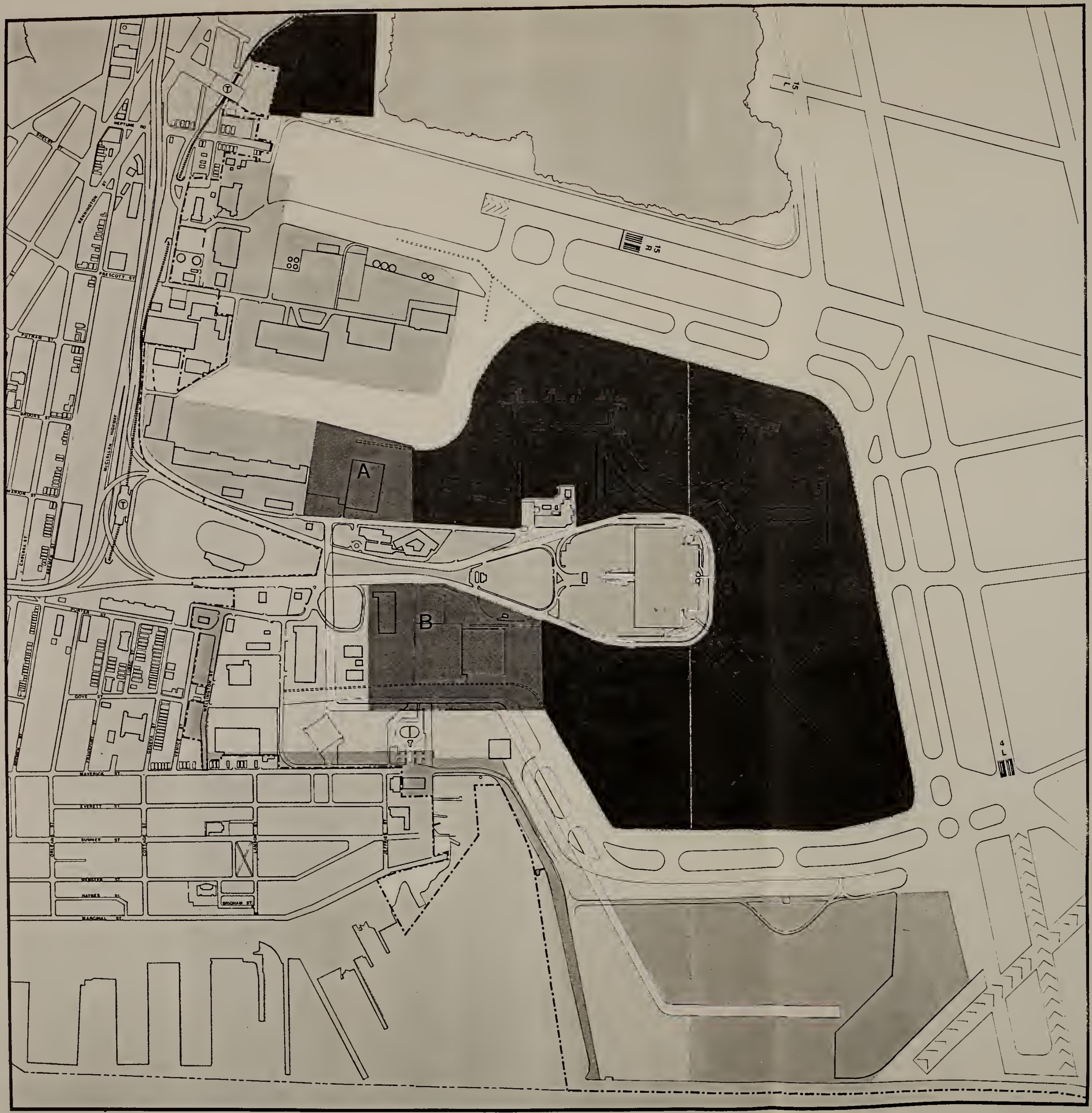


Figure 3.3

Land Use Zones

-·-·-·- Airport Boundary

▨ Terminal

▭ Apron Access

■ Airside Vehicular Access

▭ Landside Access

▭ Central

▨ Multiple Use

A Terminal or Apron Access

B Apron, Airside Vehicular or Landside Access

▭ Buffer

Logan Land Use Master Plan
Massachusetts Port Authority

Wallace, Floyd, Ellenzweig, Moore, Inc./Griffith Associates
Architects/Planners

November 1981

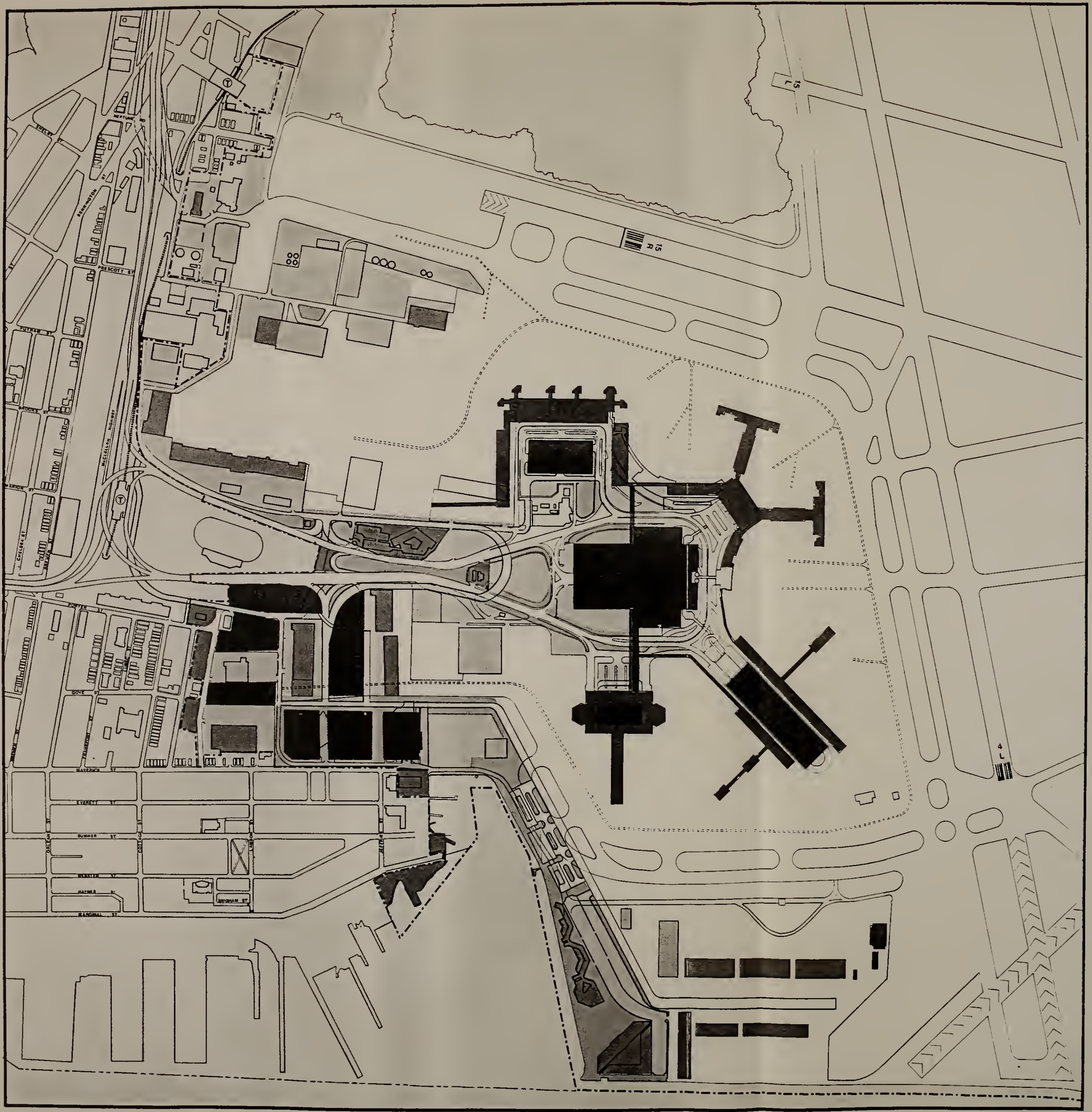


Figure 3.4

Package A, Moderate Capital Investment

-·-·- Airport Boundary

■ Terminals

▨ Passenger Service Facilities

□ Airline Support Facilities

▨ Cargo and Mail Facilities

□ Airport Support Facilities

□ At Grade Parking

■ Rental Car Areas

■ Garages

□ Landscaped Areas

▨ Transitional Parcels

0 500 1000 feet 2000

Logan Land Use Master Plan
Massachusetts Port Authority

Wallace, Floyd, Ellenzweig, Moore, Inc./Griffith Associates
Architects/Planners

November 1981

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In

Package Two: Higher Capital Investment

Terminals Access to Southwest Terminal is rebuilt and the curb extended further than in Package 1. South Terminal is extended toward BIF, providing three additional gates. At North terminal, a longer stretch of Pier A is reconstructed and upper level curb is extended further than in Package 1. A modified Volpe Terminal and its new wings are served by a two-level roadway. Instead of an overflow aircraft apron, a commuter terminal is built with gates for six 30-seat aircraft.

Parking "Air rights" garage floors are built between Southwest Terminal, the Central Garage, and Pier A. An exit ramp from Central Garage to Pier D is provided to complete the vehicular link with the terminal. South Terminal garage is extended to accommodate an additional 800 cars. A parking garage is built at Volpe as in Package 1. A detached garage is built in the central area to accommodate rental ready cars (west end) and long-term parking (east end); this garage is connected to the terminals by an elevated bus loop.

A 2200-car lot near the Marriot Flight Kitchen is constructed for airline and Massport employee use.

Roadways The North-South Roadway is diverted into a two-way bridge loop east of the Hilton Hotel thus increasing capacity on the Inbound and Outbound Terminal Roadways. An interchange with the highway (not shown) has been built at Neptune Road, and the Service Road connection to Neptune road has been rebuilt on land acquired from the Robie Airport Park. The main ramps to and from the second level in the terminal area have been relocated to the west, allowing the choice of level to be separated from choice of terminal. Volpe Terminal is served by a two-level roadway.

Southwest Service Area The air mail facility is relocated to BIF or the North Apron. The area vacated by general aviation is divided between a buffer of community-oriented uses facing Maverick Street, and car rental facilities, freight forwarding or food preparation buildings facing the airport service road.

North Service Areas. This package differs from Package 1 in that Robie Airport Park is redeveloped to provide a better service road alignment and additional air cargo facilities.

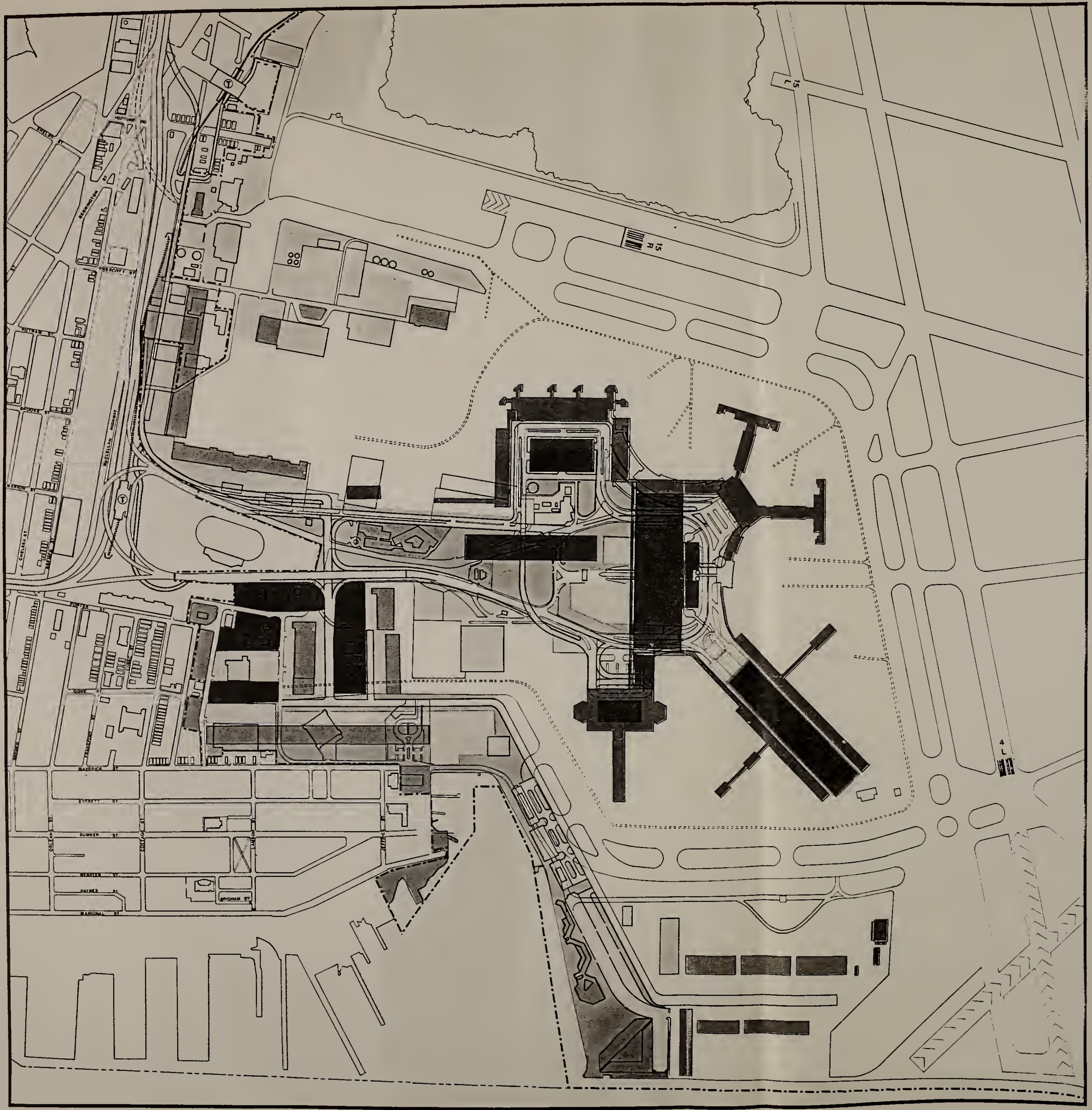


Figure 3.5

Package B, Higher Capital Investment

-·-·-· Airport Boundary
▇ Terminals
▨ Passenger Service Facilities
☐ Airline Support Facilities
▨ Cargo and Mail Facilities
☐ Airport Support Facilities
☐ At Grade Parking
▇ Rental Car Areas
▇ Garages
☐ Landscaped Areas
▨ Transitional Parcels

0 500 1000 feet 2000

Logan Land Use Master Plan
Massachusetts Port Authority

Wallace, Floyd, Ellenzweig, Moore, Inc./Griffith Associates
Architects/Planners

November 1981

Chapter 4 Urban Design and Airport Edge

The physical quality of Logan Airport has an impact on both the users of the airport and the residents of the neighborhoods surrounding the airport. This chapter addresses urban design issues from these internal and external perspectives.

Although the two discussions are undertaken separately, they are strongly linked. The design recommendations for each area have been evaluated for their impacts on the other. The urban design guidelines for many issues are the same for internal parts of the airport and its edge. If the design guidelines which are recommended are followed throughout the airport, they will have a positive impact both within the airport boundaries and on the airport's appearance to its neighbors.

Airport Urban Design

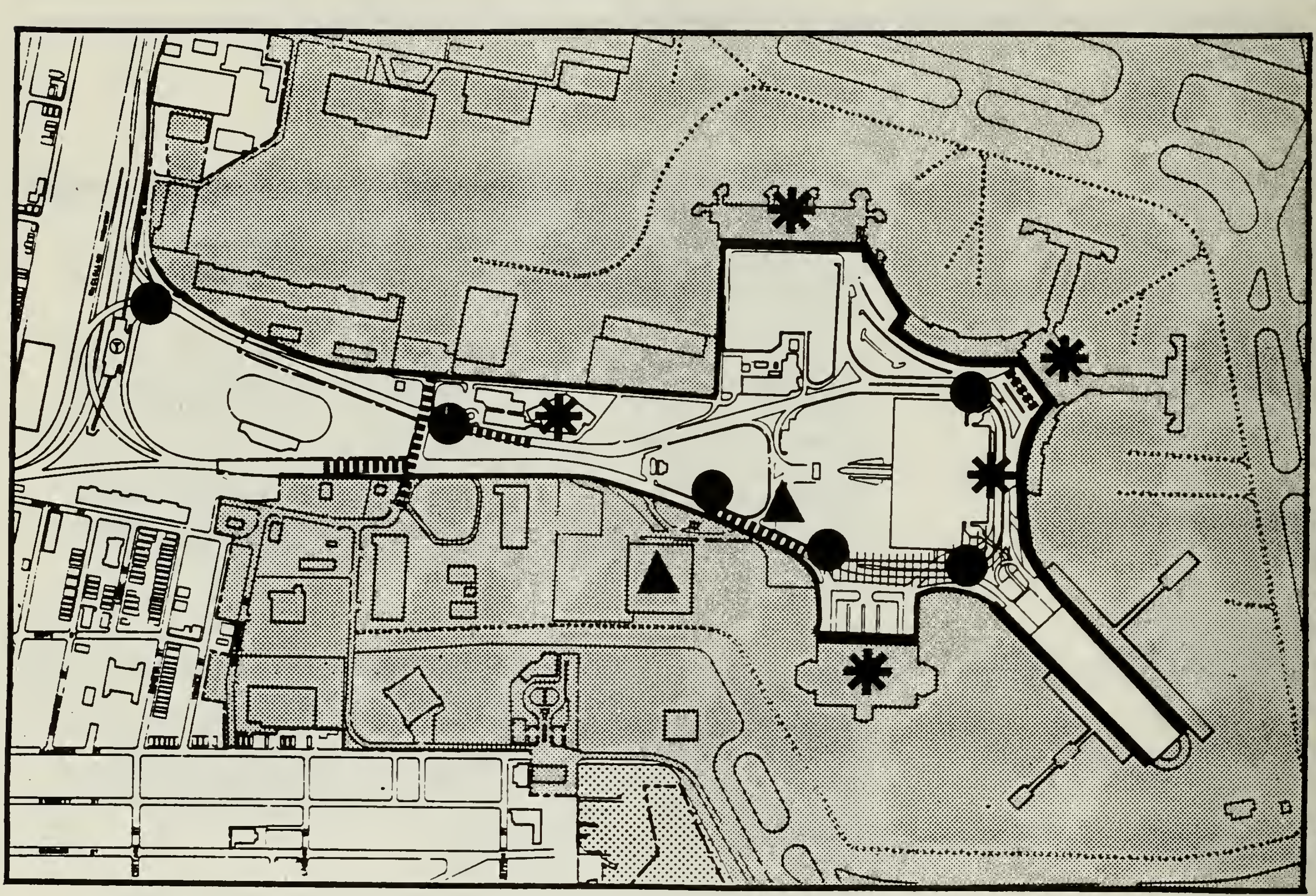
Logan Airport is the front door to the City of Boston. It is important to Logan's function as a regional transportation center that the airport be perceived as a handsome and convenient facility. The goals of urban design at the airport are to provide an understandable, easy to use, and aesthetically pleasing environment for the movement of people and goods.

The airport has four primary user groups; occasional travellers and their companions, frequent travellers, airport employees and service personnel, and cargo transporters. Although these groups have different patterns of airport use, they are all primarily concerned with moving through the airport as quickly and conveniently as possible.

Urban design for the airport is unlike that for most other urban environments. The airport is used at high speed and, except for employees, by largely transient user groups. The airport makes its impression during the user's brief stay. The appearance and organization of the airport should promote its function as a transportation hub.

Existing Conditions

Logan Airport has developed over the last thirty years into a major national and international airport. The airport's physical image is the result of many different building projects. Although individual elements of the airport are often architecturally successful, the overall image of the airport can be improved in functional and spatial definition. The airport's varied terminals and service buildings are interesting forms and provide the airport



Terminal Loop Urban Design Characteristics Figure 4.1

▬ Building Edge

— Soft Edge .

✱ Landmark

● Confusing Information

▲ Inadequate Information

▥ Confusing Area

▮▮▮▮▮▮▮▮ Traffic Congestion

0 500 1000 feet 2000

user with landmarks and the airlines with distinctive physical characteristics. However, there are no themes or design elements which tie the disparate elements together. This is needed to create an environment which users can comprehend and can therefore use conveniently and comfortably.

The airport's most important design problem is the lack of clarity for users. People who infrequently use the airport often get lost, miss road turn-offs, or cause traffic congestion and safety problems when they slow down to get their bearings. Although regular users of the airport are able to find their way, the overall system is also inefficient for them.

Th environmental quality of the airport is uneven, with certain elements presenting a positive image, and others being unattractive. The airport is perceived as a series of separate facilities and not as a unified whole.

Components of Urban Design

Three primary aspects of urban design which require improvement have been identified at Logan. These are: the organization of space; the clarity of information; and the aesthetic quality of the airport.

Organization of Space. This aspect of urban design is concerned with the location of different functional areas in the airport and how they are perceived by a moving observer such as a passenger arriving in an automobile or the driver of a cargo truck.

View toward the terminal area from the highway access ramps.

The movement of people at Logan is concentrated along several corridors serving a variety of different airport functions. The differentiation of the functional areas is not always clear or complete, such as the location of a hangar service entrance used by employees between car rental areas and terminals used by passengers. In some areas the corridors themselves are poorly defined, as in the Southwest Service Area and at Neptune Road.

Organizing space at Logan into a coherent set of functional zones and movement corridors will make the airport easier for users to comprehend. Although it is impossible, and undesirable, to create a completely rigid organization of space, urban design at Logan should contribute to a greater sense of organization than now exists. The land use zone system described in Chapter 3 is the cornerstone of this aspect of urban design at Logan.

Clarity of Information. Using the airport requires the absorption of a great deal of information while moving through a complicated environment. For example, using the terminal approach road requires being in the correct lane for ramps to each of the terminals. Much of the information must be digested while driving at high speed on

The roadway split at the Southwest Terminal exit.

congested and curving multi-lane roadways.

The existing information systems at the airport do not adequately distinguish between basic pieces of information which all airport users need to know, and details for using a particular zone. Airport users suffer from both an information overload and inadequate information.

There are a number of urban design components which can contribute to clarifying information at Logan. These include both direct measures such as signage and color coding for buildings, and indirect measures such as varying roadway widths and consistent roadway edge treatments.

Aesthetic Quality. This is the most difficult aspect of urban design to define, and to succeed in achieving. However, there are some basic "norms" of design within which the airport can achieve great variety and yet present an overall appearance which will be pleasing to most people.

The present appearance of the airport is a result of many different, uncoordinated design decisions. A design approach is needed which is equally concerned with how individual buildings fit into the total environment as with the internal functioning and specific image of each structure.

In dealing with an environment such as the airport which serves a transient user group concerned with efficiency, the aesthetic qualities of the environment must be seen as contributing to its function. The facilities at the airport are massive in size and exterior spaces are almost always seen from inside a moving vehicle, therefore many of the aesthetic improvements at the airport must be easily perceived at a large scale and must act quickly on the viewer.

There are opportunities for finer detail within each functional zone where exterior spaces relate to pedestrians and where the interiors of buildings are concerned. Particular attention to interior design is required within the airline terminals where a promotional as well as functional purpose is being served. The terminal zone and building interiors are used by people moving slowly, and in some areas waiting for substantial periods of time, these areas clearly require different design treatments from exterior spaces where people are moving rapidly.

Integration of Design Components

The three aspects of design described above are not independent; in fact each one is dependent on the other for its success. Their main purpose is to provide a structure for composing an overall urban design strategy. The primary means for improving the organization, clarity and aesthetic quality of Logan Airport is to:

Make use of a series of physical systems to establish a hierarchy of functions and spaces which define the airport's structure for its users.

The establishment of a hierarchy of functions and spaces extends from very broad distinctions at an airport-wide scale, to detailed spatial organization within subareas and terminals.

It is clearly not feasible to achieve a rigid ranking of functions and spaces at the airport and might be undesirable to do so if it were possible. Rather, approaching closer to a loose hierarchy with some variations for interest and practicality can provide the means for improving the airport's urban design quality.

The hierarchy will be roughly based on intensity of use and speed of movement. Thus, for example, the Terminal Roadway Loop is the primary roadway, and service roads and local terminal circulation should be clearly distinguishable from it. At a functional level the most important distinction to establish is between the Terminal Zone and the Service Areas. Within the Terminal Zone each terminal should be differentiated from all the other terminals.

The following list provides examples of the hierarchies from large scale/high speed movement, to small scale/low speed movement.

Airport Wide Scale - Distinguish the terminal zone from the service areas.

High Speed Movement - Distinguish the Main Loop Roadway from the service roads.

Building Scale - Distinguish each terminal from the others.

Low Speed Movement - Distinguish pedestrian crossings from vehicle-only areas.

Pedestrian Scale - Distinguish pedestrian paths from general vehicular circulation within garages, curb areas, and paths between terminals.

Interior Building Scale - Distinguish quiet waiting areas from active circulation, check-in and baggage pick-up space.

A hierarchical framework will help to produce clarity by sorting out different airport functions and areas for the user. If the information about service areas looks different from that about the terminal area, someone who wishes to use the terminal area will be able to quickly perceive the difference between the terminal roadway and the service roads. Any information which appears about the service areas can be filtered out without difficulty. Likewise, if a particular color is identified with a particular terminal, other colors can be ignored by the user.

In order to address the issue of creating a hierarchy of functions and spaces the airport has been studied as a series of inter-related physical systems. These systems can be integrated to form a framework of information which can be understood easily by airport users. The systems will be used in combination to help delineate different functions and can enhance the sense of hierarchy of functions and spaces. The systems for which recommendations are made are:

Land Use Zones
Roadways and Pedestrian Routes
Building Form
Landscape
Lighting
Color
Signage

The systems are interdependent and must be structured to work together. The three components of design: organization of space, clarity of information, and aesthetic quality, have each been addressed in the selection of guidelines for the systems. The systems already exist at the airport, but they can be improved upon. In many cases the decisions of different designers have resulted in a lack of continuity between, for example, the lighting in South Terminal and Garage, and the lighting in the Central Garage.

Design guidelines provide a means of coordinating design decisions over time and will improve the consistency of the systems on an airport-wide basis. The improvements to airport urban design should be undertaken as part of incremental change over time. They should be incorporated as growth occurs and new or rehabilitated facilities are needed, or, in some cases, they can be instituted at one time as an overall airport improvement project, such as replacement of signs. The hierarchy of design guidelines for the systems which are recommended are not completely rigid. Variation should occur where it will contribute to clarity and aesthetic quality.

In the sections that follow, each system is first described in terms of its overall impact on the airport environment. A series of design guidelines is then made, starting with large-scale issues and proceeding to more specific and small-scale recommendations.

Design Guidelines

Land Use Zones

The land use zones as described in Chapter 3 provide the underlying spatial organization for the airport. The zones

Roadway landscaping at Miami International Airport.

organize the airport into a rational clustering of similar land uses, and the long-term result of following the zones will be a reduction of conflict between incompatible uses, and an increase in operating efficiency in the service areas. The land use zones are designated based on different types of access: apron, landside, airside vehicular and passenger access.

There is only one design guideline for this system:

o Follow the land use zones as described in this Master Plan.

[Non-conforming uses already in place can remain, but new uses should follow the zone system. Interim non-conforming uses should not entail large investments which will lead to abandonment of the zones.]

Circulation System, Roadways and Pedestrian Routes

Logan's chief function is movement of people and goods and its movement corridors create the basic physical structure for landside portions of the airport. Every person who uses the airport (except for transfers between flights) enters and exits via the Main Loop Roadway, and then branches onto other roads; pedestrian paths are the slowest rate of movement in the overall circulation system.

The primary function of the circulation system is the efficient movement of people and goods, this function demands that the system be well organized and understandable to its users. The secondary function of this system is to provide an attractive "gateway" to and from Boston.

o Create a clear distinction between the Terminal Loop Roadway and other airport roads.

To accomplish this use specific design features such as roadway width, signage, lighting, and landscaping.

o Clarify decision points along the Terminal Loop Roadway.

The turn-off to each terminal should be clear (the entrance to South Terminal, and lower level access to Volpe Terminal are existing trouble spots), as should exits to service areas and parking areas. Excessive, and therefore confusing, exits such as to the taxi pool or the closed, rear entrance to the Central Garage, should be removed or greatly de-emphasized.

o Align the Main Loop Roadway and Service Roads to maximize good views.

Views of the airport and the Boston skyline will provide both aesthetic quality and a sense of orientation. Good views of Boston already exist from the Inbound Terminal Roadway, however extraneous signs and inelegant rental car lots in the foreground distract from the view. Likewise, views of the terminal area can be enhanced by removing any clutter such as extra signs or poorly maintained fences from the foreground. When roadway improvements are designed for the Main Loop Road and within the service areas, views should be considered as an important design criteria.

o Improve roadway edge conditions and create a unified system of edge treatments.

The Main Loop Roadway and service roads are abutted by many different airport uses and tenants, each of them has fenced their parcel independently and with minimal attention to appearance from the road-side. A system of edge treatments which is consistent and attractive should be created, with low opaque fencing and landscaping used to screen parking lots, loading areas and other expanses of paved area. Where jet blast fences are required, they shold be landscaped to coordinate with other edge treatments. Extraneous signs, gates and curb cuts should be removed. Maintenance of the roadway edge should be given high priority.

Pedestrian connection between Southwest Terminal and the Central Garage.

o Establish a terminal zone pedestrian system which links all terminals and garages with safe and attractive pedestrian routes and establish a people mover corridor in the terminal zone for potential future implementation.

The pedestrian routes should be clearly marked, barrier-free, well lit, and clearly distinguishable from vehicular routes. Special attention is required to create safe, attractive and visible pedestrian routes within the garages. Wall mounted pedestrian oriented airport maps should be provided throughout the terminal zone. The people mover corridor may remain as a pedestrian path or may eventually accommodate a vehicular system. However, the space should be reserved to insure its availability. The reserved corridor may act as a pedestrian spine through the terminal zone running from Southwest Terminal along the Central Garage to the Volpe and North Terminal extensions (see Figures 3.4 and 3.5).

Pedestrian path at a major international airport.

Building Form

The terminal area buildings at Logan are large structures which have been designed with attention to their individual character but without equal attention to design compatibility with each other. The design of structures in the service areas has been to a great extent guided by function and cost rather than aesthetics. These three criteria are not incompatible and can be addressed by unified design guidelines.

The majority of buildings which the airport will need for the next forty years are already in place. However, some new buildings and additions will be made. If these new structures follow the guidelines listed below they will form enough of a framework to tie most of the buildings into an overall system.

o Maintain and enhance landmarks.

The Control Tower viewed from Southwest Terminal.

The primary landmark at Logan is the terminal tower. The tower is a powerful form when seen from a distance, but as one approaches the terminals it is hidden from view or obscured. Efforts should be made to permit the tower to remain visible, and to provide some identification of the base of the tower as connected to the tall structure which people recognize. Other landmarks which currently exist are Southwest and Volpe Terminals, the Hilton Hotel and the playing field/stadium area. Efforts to maintain these landmarks will be made, (designs for the connection of Southwest Terminal to the Central Garage deliberately do not obscure the terminal facade), however, in some cases this will be difficult (construction of garage in front of Volpe).

New landmarks can be created which are powerful visual elements. The people mover corridor and automobile connections between Southwest, North and Volpe Terminals and the Central Garage will be visible from many vantage points and can be a strong, organizing element within the terminal zone. This connective element can be visually highlighted to serve as a landmark. The proposed hotel over the Airport MBTA station also presents the opportunity to create a new landmark.

Within the service areas landmarks can be created by allowing a particular building to become a focus of attention. Particular attention should be given to the landmark quality of the potential mixed use development on BIF. The development could be visible from the Main Loop Roadway and from the road through the Southwest Service Area, and could act as a visual focus for people approaching the development.

o Orient structures to promote clarity and enhance views.

Some of the airport's existing buildings are oriented to coincide with the roadways, others are not. New buildings should relate to roadway alignments to promote the spatial definition of corridors and differentiation of various airport zones. Where new roadways are built in the service areas, new buildings should follow their alignments (see north service area in Package 2, Figure 3.5). Within the terminal zone, building additions should help to define the space and should not be perceived to be at odd angles relative to the roadway. New buildings should be placed to help define views of the terminal area or the Boston skyline.

- Promote the identity of individual terminals.

The building form of the terminals is fairly well established, however additions and renovations can help to define different identities for the four terminals. Where possible, established building lines should be continued; or, in the case of Volpe, the additions should create a new sense of definition for the international terminal area. Where the airport buildings create a continuous structure, color, lighting and signage should be used to distinguish individual terminals.

- Follow Massport design guidelines for new and rebuilt service area buildings.

A series of specific design guidelines have been adopted for development on BIF of new service buildings which describe their dimensions, appearance and site layout. These guidelines should also be followed in the airport's other service areas where they will help to insure the gradual design improvement of the service areas when buildings are replaced or rehabilitated.

Landscape

Logan's existing landscaping should be enhanced and extended. The size, function, and materials of the terminals and parking structures at the airport cannot be easily varied. The provision of attractive landscaping which runs throughout the airport can both soften the appearance of the massive structures and provide a sense of continuity.

- Establish major landscaped areas in the Central Zone.

The portion of the airport which has the most area available for landscaping, and which has the greatest impact on the airport's image to its users, is the land which lies within the Terminal Roadway Loop. This part of the airport lies on the visual corridor of anyone who arrives at or leaves the airport. Major landscaped areas should be located where they will be most visible to people driving into and out of the airport along the Loop Roadway. These landscaped elements should be large enough to create a distinct impression and should contain a mixture of planting to insure year-round greenery. Lighting should be used to insure that the landscape is effective after dark. Any at grade parking in the Central Area should be screened by landscaping.

- Create a landscape system for the terminal area.

Landscaped areas should run as continuously as possible through the terminal area to provide human scale contrast in the dense concrete areas. Although it is clearly not possible or desirable to make a garden of the airport,

Landscaped outdoor waiting area at a major airport.

enough landscaping should be provided that the impression of a cultivated and cared-for environment prevails.

Landscaping in the terminal area should follow a basic theme, within which each terminal can develop individual designs. One theme which has been suggested, but which needs further study, is native salt water coastal vegetation. Landscaping in the terminal area should be used to create a low-key, continuous urban design element with pockets of denser planting. The background planting should be used both in outdoor areas and within the terminals. The pockets of denser landscaping may serve as foci for waiting areas, both inside and out.

- o Create a consistent landscape treatment for edges of the Loop Roadway and service area roads.

As discussed under roadway improvements, edge treatments should be improved and unified throughout the airport. One important part of the edge treatment is landscaping. Within particular airport zones there should be consistent landscaping, and there should be different treatments in different zones. Thus, one roadway edge landscape type should be used along the main Loop Roadway and another in the service areas. The band of landscaping along the Loop Roadway should be denser than that along the service roads. One section of roadway which will require particular attention is the access road to BIF. This road passes through the service area, but will be used by business and passenger traffic and should provide an attractive approach to the new development.

- o Design a buffer strip landscape system.

The creation of a landscaped buffer strip is one of the important means of mitigating the airport's impacts on its neighbors. The design of this buffer must be carefully worked out to maximize the visual buffering of the airport without having an adverse impact on noise buffers. (See WFEM/GA 1979 Summer Report to Massachusetts Port Authority for a detailed discussion of noise buffers.) The precise dimensions of the buffers and the abutting airport-side uses have not been determined yet, however it is important that this aspect of landscaping be given careful attention.

Lighting

Lighting can be an effective tool of urban design. Although the airport currently has adequate levels of lighting, it is only used at a few locations to distinguish different zones (pedestrian crossings at South Terminal). Certain minimum levels of lighting are required for safety, but within a large range, the levels, color and placement of lights can help to increase the airport's legibility and create distinctions between different functional areas and different movement corridors.

o Create an airport-wide hierarchy of lighting.

The lighting hierarchy should be consistent and fairly rigid. Exceptions can be made where the lights cannot be seen from public areas. Distinctive lighting types are required for the following uses (the particular lighting types noted are only given as examples, a detailed study of lighting needs, aesthetics and energy and fixture requirements must be made to determine actual lighting design):

- Main Roadway and lighting of main roadway signs - overhead "blue-white" light
- Service Roadways and lighting of service area signs - overhead "yellow" light
- Pedestrian Paths and signs - overhead or side lit "soft white" light
- Garages and signs - overhead "yellow" light
- Interiors - overhead or side lit "soft white" light
- Waiting areas and attractive design features - "pool" and "spot" lighting to stand out as warm areas, "white" light.
- Landmarks - spot light to enhance their orientation function.

o Make use of creative lighting design for pedestrian scale areas.

As, for example, the yellow light used to mark pedestrian crossing in South Terminal.

Color

Color is an urban design element which can have a major impact on the appearance and clarity of the airport. The range of building scales and movement speeds at the airport requires that color be used boldly in some areas and with restraint in other locations.

o Create two color codes for the airport; one for the Terminal and Central Zone and one for the service areas.

Color is a powerful organizing element because people remember colors much more easily than they remember written information. The color systems for the airport will be used in a manner similar to that used in the MBTA, each major component will have a unique, identifiable color.

Within the Terminal and Central Zone each major facility should be assigned a color corresponding to the color used in the signage system (see signage discussion below). Four colors will be used; one for each of the four terminals. The colors should be used wherever directional information is given; on roadway signs, airport maps, pedestrian and auto circulation signs in garages and interior terminal signs. The colors should also be used, where aesthetically appropriate, on the outside of buildings, either as simple exterior colors or as super-graphics. The terminal interiors should also make use of their assigned color to reinforce the identification system.

The service areas should also have color codes for different functions. These codes should be used in directional signs, directories of tenants and tenant identification signs.

Examples of contemporary airport signs.

Signage

Informational and directional signs are a vital element in the Logan landscape. Even those airport users who are familiar with the airport will sometimes use facilities with which they are unfamiliar. For the airport's many infrequent users, signs are the vital link to finding their way. The existing signs at Logan are very uneven in quality; some are easy to understand and are placed in appropriate locations, others are confusing, or are located so close to the facilities they identify that drivers do not have time to react to them.

Massport recently commissioned a major design study of Logan's signage. The designs which were recommended use number and color codes to identify Terminals and Central Zone activities. The signage system would extend to all parts of the airport including terminal interiors and service areas. The study recommended that all signs in the airport follow the same design guidelines for color, lettering, structure, lignting and materials, and that all non-conforming signs be removed.

The signage study also examined the placement and content of signs on the Main Loop Roadway and made recommendations about the spacing, quantity and content of signs to increase the clarity of the airport.

A demonstration project of signage for the Central Garage is underway. This signage plan uses color codes to identify terminals and numbers and symbols to identify garage floors.

The establishment of a consistent and high quality sign system at the airport will contribute to the clarity and aesthetic quality of the airport. Implementation of the recommendations should begin now and continue as improvements are made in different parts of the airport. The signage system should be flexible enough to respond quickly to changes in airport facilities.

Airport Edge

As in other cities where an airport has developed within the urban fabric, the edge conditions of Logan reflect the meeting of conflicting land use zones. The presence of the airport has a major effect on the environment in surrounding neighborhoods. The two main negative effects are: first, the environmental impacts of noise, air pollution and heavy traffic which have contributed to a decline in maintenance and reinvestment in the neighborhoods. Second, as residential use has declined, airport-related uses such as cargo forwarders and park-and-fly operations have been moved into the neighborhoods and caused further land use impacts. The many instances of good maintenance and reinvestment in the impacted areas are due to the strong social fabric of the neighborhoods and have occurred in spite of the impacts described above.

One reason that Logan's neighbors have suffered is that during the airport's main period of expansion there was uncertainty about the airport's plans. Any advances that might have been made to slow decay through zoning or other controls on airport related development were thwarted by this uncertainty. Since the 1976 Master Plan there has been a change in Massport operations. Airport expansion has slowed, the community's influence on Massport policy has grown, and the airport has begun long range planning. At this time the boundary of the airport has been declared fixed with no new land acquisition anticipated. The stage is thus set for improving the airport edge conditions, both on the airport and the community sides.

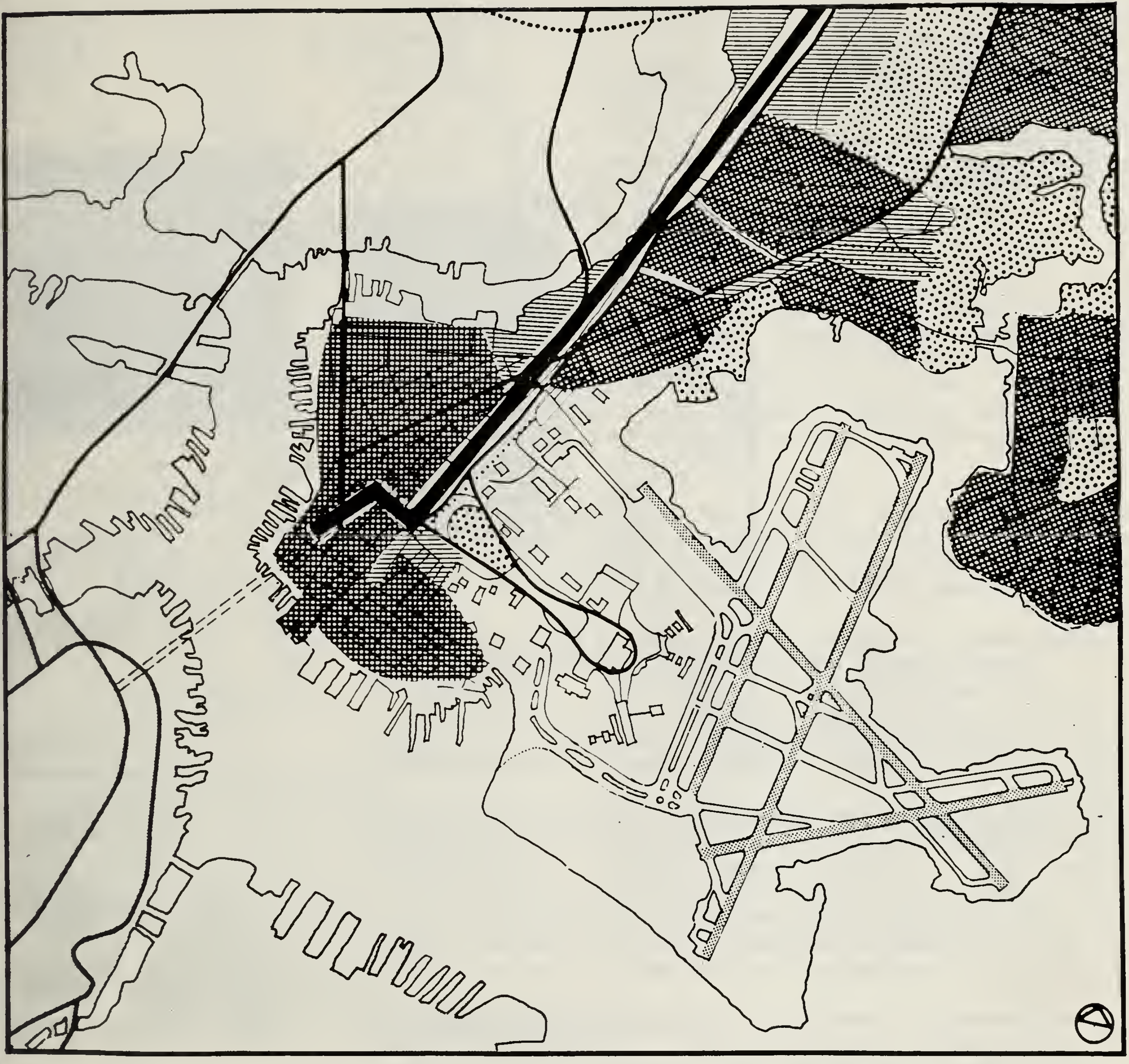
The Land Use Zones developed in this Master Plan are geared toward provision of a buffer zone as well as functional issues such as the provision of appropriately-sized leasable parcels and the division of land into parcels with and without airside access. The amelioration of edge conditions on the community side involves more difficult issues. The primary improvements needed are reduction in noise levels, reduction of air pollution through the minimizing of airport traffic, protection against further expansion of airport-related uses, and improvement of the appearance of the airport edge.

Airport Side

The arrangement of parcels and buildings on the perimeter of the airport will be designed by Massport to meet parcel depth requirements and circulation requirements. The development must also meet the needs of the community side for noise barriers and visual improvements.

Community Side

The airport is surrounded on three sides by the residential communities of East Boston to the south and west and Winthrop to the northeast. The nature of the airport's



Community Context

Figure 4.2

▩ Residential

░ Recreation/open space

▤ Industrial/transit related

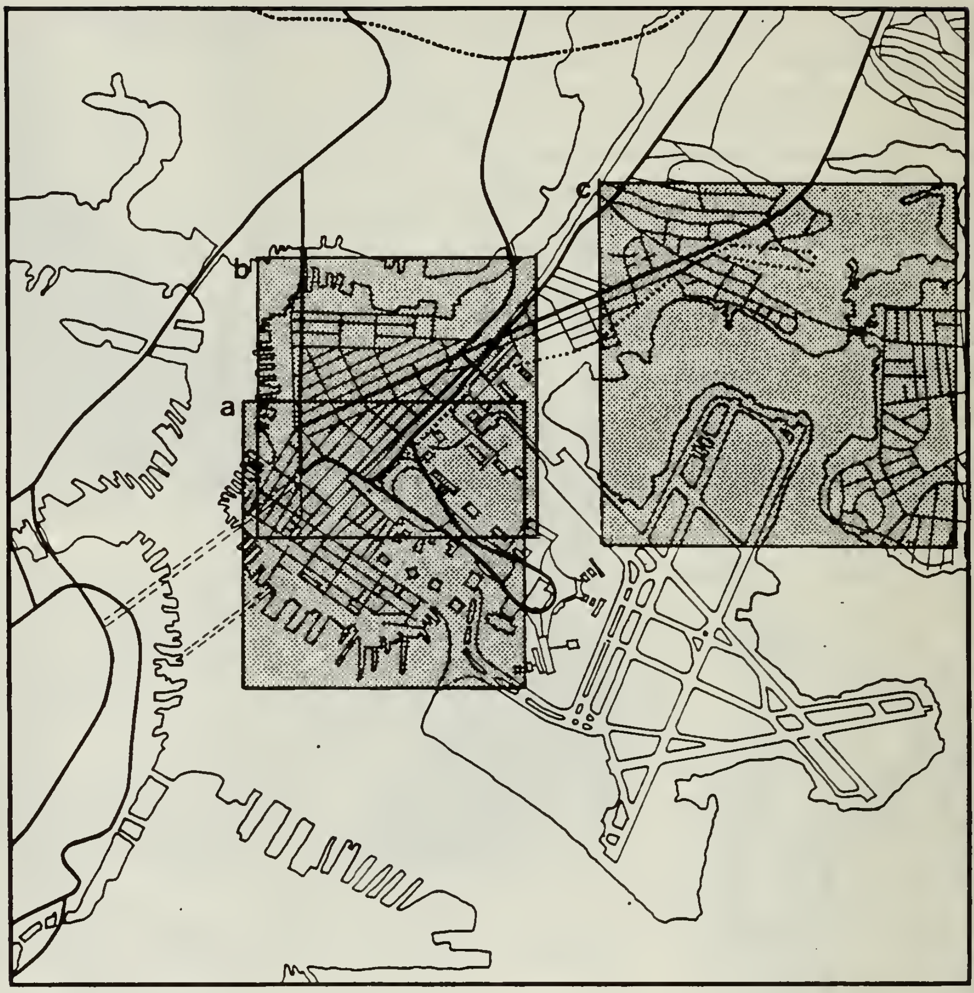
■ traffic corridor

0 1600 3200 feet 6400

Figure 4.3

Neighborhood Map Key

a. Jeffries Point
b. Day Square, Neptune Road, Bremen Street
c. Winthrop, Orient Heights



impact on these communities varies widely. Some of the problems caused by the airport can be ameliorated while others cannot. The impacts of ground noise, (both truck and aircraft), airport traffic in the neighborhood and visual intrusion can be substantially reduced. The noise of airplanes once they are off the ground, and the air pollution which accompanies their takeoffs and landings, has been reduced in recent years through the use of noise abatement and runway assignment procedures but are difficult to improve further.

Winthrop and Orient Heights. The Town of Winthrop lies across the tidal flats and boat channel from Logan. Approximately 750 feet of water separates the closest residential street from runway 4R/22L. The impacts of the airport on Winthrop are noise and air pollution. There is little spillover of airport related activities. Noise barriers would not be effective against takeoff and landing noise.

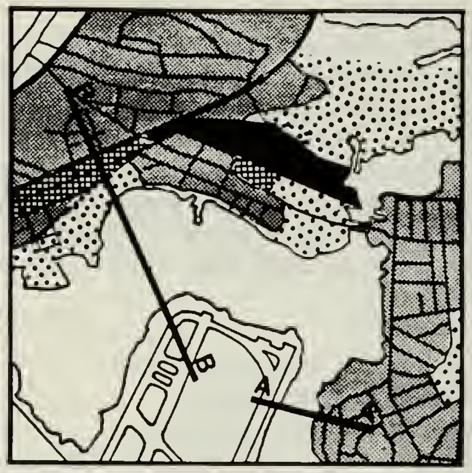
The routing of planes and the evolving noise and air quality characteristics of planes will make a difference in Winthrop. As aircraft are designed to run quieter and more cleanly, the airport's neighbors will suffer less.

Orient Heights is a residential neighborhood in East Boston which lies at the end of runway 4/22. Orient Heights Beach, a popular city recreation area, lies close to the end of the runway. The airport's impacts on Orient Heights are much like its impacts on Winthrop; the potential improvement techniques are similarly limited.

Day Square and Neptune Road, Porter and Bremen Streets, Jeffries Point. These East Boston areas are impacted quite differently than the areas mentioned above. In addition to noise and air pollution impacts they also suffer from airport traffic and ground noise and the spreading of airport related activities. Specific recommendations can be made for ameliorating some of the problems.

Day Square and Neptune Road lie northwest of the airport. Access to highway (C-1) from the airport's North Service Area involves a circuitous route through this part of the community. The heavy truck traffic causes air and noise pollution and creates safety problems on local streets. The homes on Neptune Road are at the end of runway 15/33 and are severely impacted by noise. Massport's policy for the last eight years has been to buy the homes in this area and help relocate the residents. In the last few years this program has slowed because the remaining residents have elected not to move.

Many of the problems caused by heavy airport traffic would be relieved by the construction of improved ramps to and from C-1. Two possible solutions are illustrated in Chapter 8 (Figures 8.17 and 8.18). Either of these



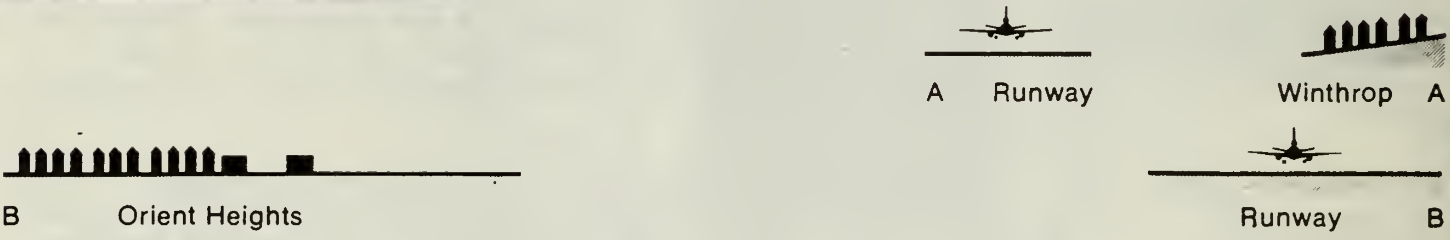
Winthrop and Orient Heights Neighborhoods Figure 4.4

▨ Residential

▩ Commercial

■ Industrial/Transit Related

░ Recreation/Open Space



Winthrop residential area.

Orient Heights Beach view of aircraft waiting to take off on Runway 22R.

alternatives would remove airport traffic from community streets and improve the efficiency of airport operations. One residential taking would probably be necessary.

The use or possible reuse of the Neptune Road area will not be an issue until the relocation program is complete. The area has is not suitable for residential use because of noise and safety impacts. The area should be regarded as a land bank until new land use needs surface. In the interim, Massport should maintain empty lots as landscaped areas and continue its recently initiated efforts to reroute traffic for the Marriott Flight Kitchen away from the remaining houses.

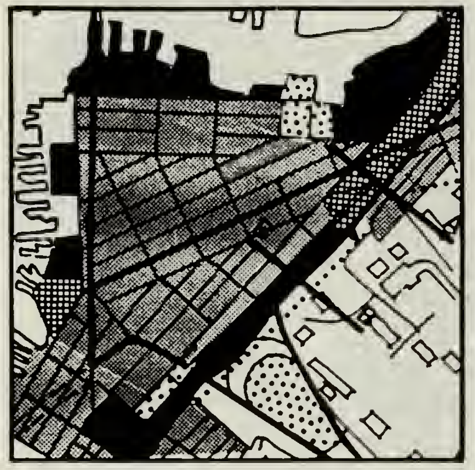
Porter and Bremen Streets border the airport. Bremen Street is separated from the airport by fully or partially elevated highways and Porter Street is separated from the highway ramp and Inbound Roadway by about 200 feet. Porter Street is used as an access road to the airport and the Loop Roadway South Service area. Bremen Street carries traffic heading for the North Service area. Bremen Street has been heavily developed by private uses related to the airport, such as park-and-fly operations. Porter Street also serves some airport-related activities and carries the vehicles which service the cargo and freight facilities which have developed on the southern end of Bremen Street.

The partial or total closing of Porter Street has been suggested as one method of limiting traffic impacts on residential areas. This action is currently being discussed by Massport; its resolution will have important implications for the design of circulation for the Southwest Service Area.

The elevated highway forms a visual barrier between the airport and parts of Bremen Street. However, airport noise is not reduced by the highway. If Massport purchases the Robie parcel and redevelops that portion of the North Service Area an "active" noise barrier can be created between the airport and Bremen Street.

The most serious problem in these two areas is the spread of airport related activities. This is a problem that cannot be solved by Massport alone, but must be addressed first by the City of Boston and local residents. (See the discussion of freight forwarding in Chapter 9.) When a commercial developer sets up business near the airport, Massport has no authority to approve or disapprove of the action. The chief ways in which Massport can help to control development outside the airport's borders are to limit the number of access points to the airport and thereby channel development into specific corridors, and to provide land on the airport itself for some of the uses. Both these actions are being discussed.

The real control over the development of new businesses in



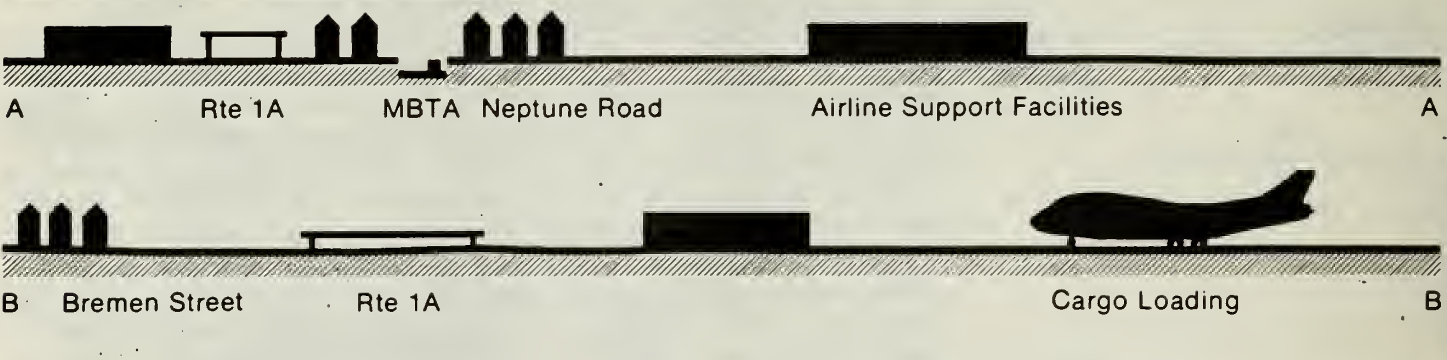
Day Square, Neptune Road, Bremen Street Neighborhood Figure 4.5

▨ Residential

▩ Commercial

■ Industrial/Transit Related

⬚ Recreation/Open Space



Neptune Road neighborhood.

View of North Service Area from Bremen Street.

Bremen Street with airport related uses.

East Boston lies with the City. The strict use of zoning controls could stop the spread of commercial/industrial uses into residential areas. In order to make use of the control's inherent in city zoning (and also use such measures as resident parking stickers and one-way street systems) the city, local residents and Massport must work together. These three groups can also work with area businesses to insure that proper maintenance is practiced and that areas zoned for commercial development are not used for storage of junked cars or empty cargo containers. Zoning changes cannot immediately terminate non-conforming uses, but prevent resumption of a use if it is discontinued. Once zoning controls are in place, Massport may be able to assist in the voluntary relocation of non-conforming uses.

The Jeffries Point neighborhood of East Boston is one of the most heavily impacted residential areas directly adjacent to the airport. In addition to the noise, air pollution, traffic and land use issues discussed above, Jeffries point also presently suffers from ground noise of general aviation and Southwest and South Terminal Aircraft. The edge of the airport directly abuts the residential community, and the spread of airport uses and impacts has severely affected Maverick, Orleans and Everett Streets. The use of Maverick Street for egress from the airport brings airport traffic through the neighborhood.

Administrative decisions can reduce impacts in addition to physical changes in airport facilities. Already, the noisier general aviation jet and turbo prop aircraft have been moved away from the neighborhood onto Bravo Apron. The closing of Maverick Street egress from the airport could take place immediately and would reduce traffic and make the neighborhood less attractive as a site for airport related commercial activities. Several Massport-owned buildings which are vacant or underutilized could take on more compatible uses. The landscaping of Massport owned empty lots will improve the appearance of the neighborhood. Massport has begun a program of such improvements.

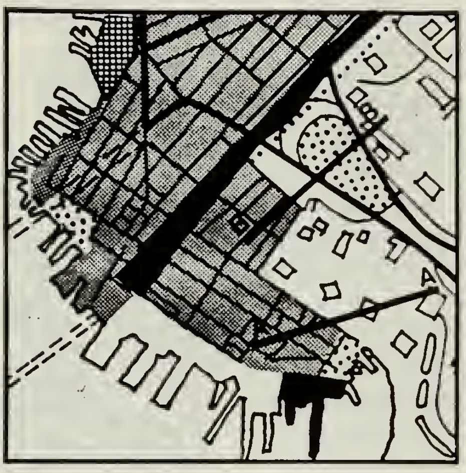
Airport Edge Design Guidelines

Specific design guidelines have been developed for the airport edge both to reduce noise and improve the appearance of the airport from the community. Issues have also been addressed in the Summer Work Report, 1979 prepared by WFEM/GA for Massport. Basic guidelines are outlined below.

Noise Buffer. An effective buffer to ground noise can be created by building a solid structural wall of adequate height between the noise source and the community. The buffer can be active (buildings) or passive (an earth berm or wall). Care must be taken to prevent gaps in the barrier, the creation of echo effects, or reduction of the

Jeffries Point Neighborhood

Figure 4.6

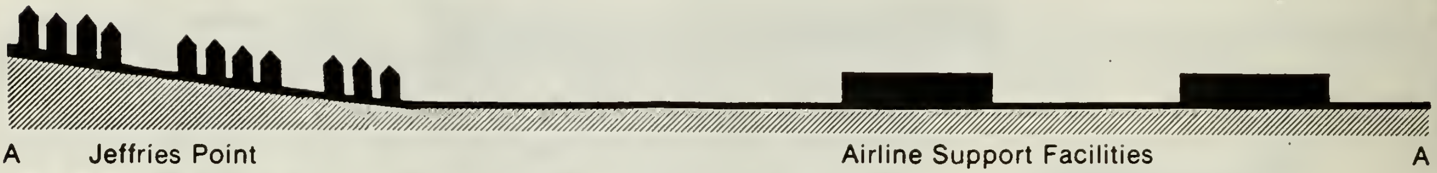


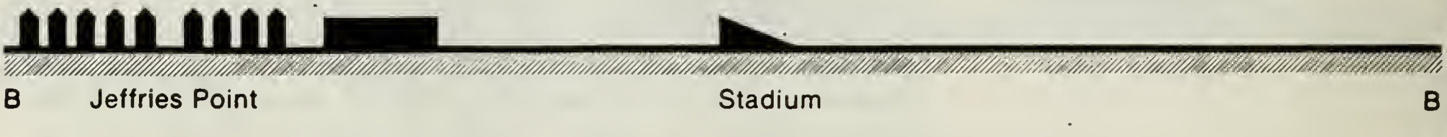
▨ Residential

☐ Commercial

■ Industrial/Transit Related

⁘ Recreation/Open Space

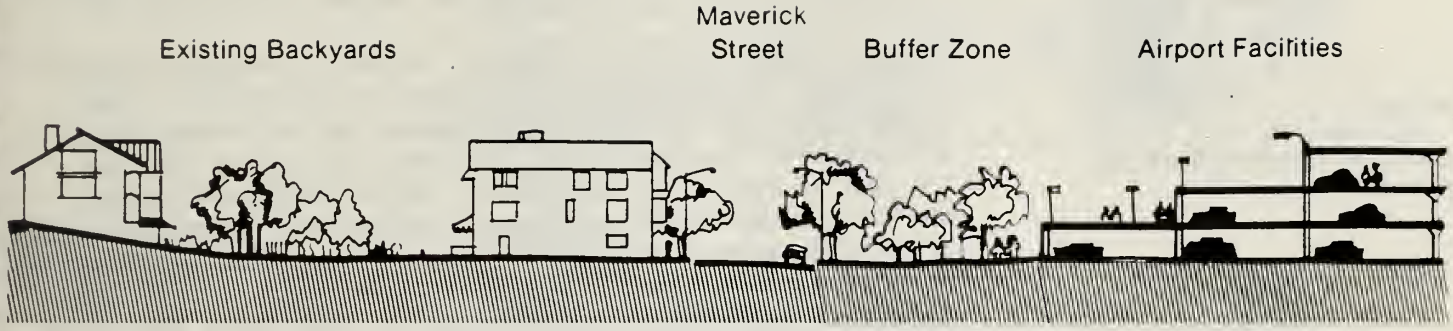




View of the airport from Emmett Street, Jeffries Point.

View of Southwest Service Area from Jeffries Point.

Maverick Street.



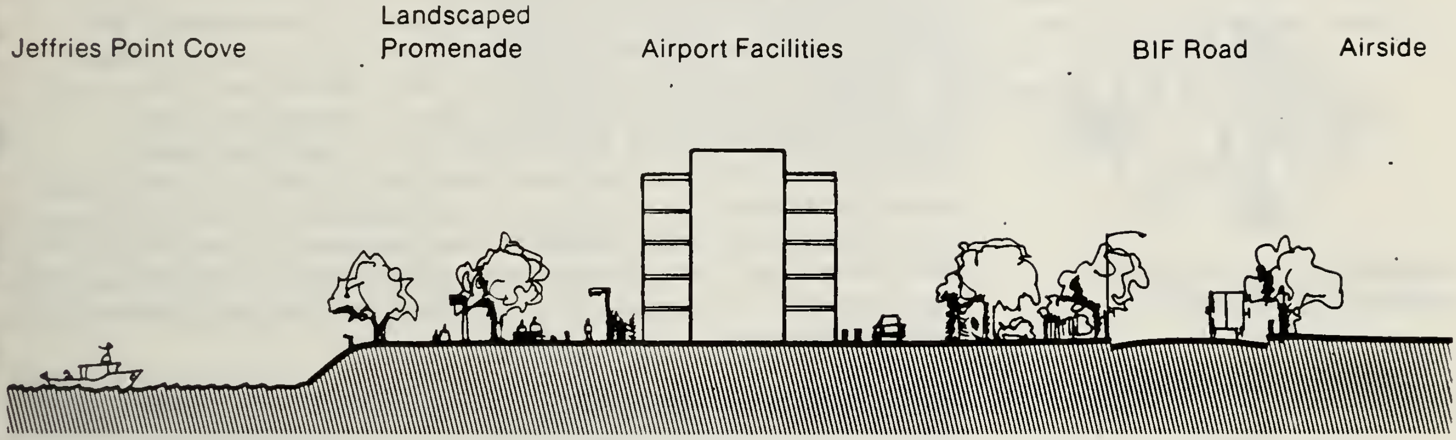
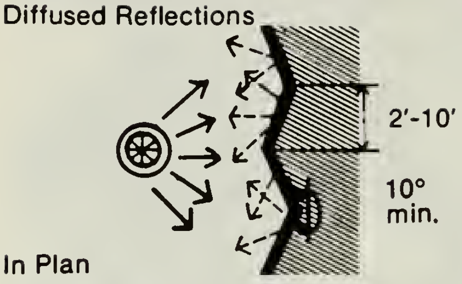
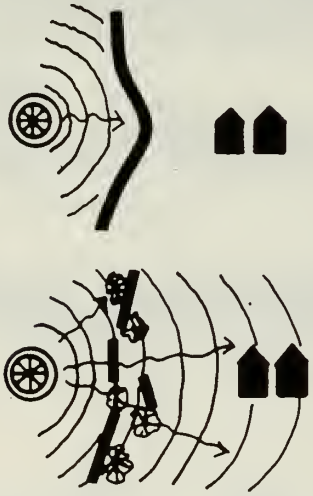


Figure 4.7

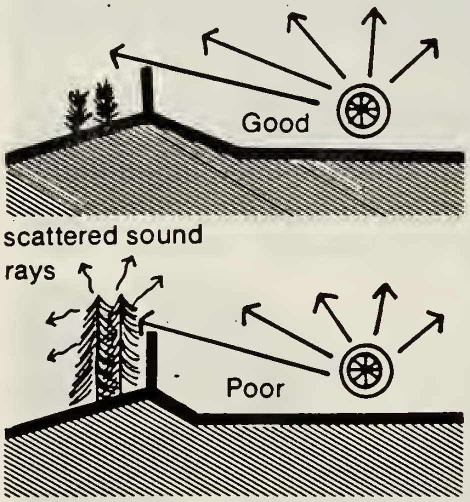
Section Sketches, Jeffries Point and BIF barrier's effectiveness through inappropriate landscaping or building alignment. The barrier must be planned well in advance of the construction of specific buildings in order to insure that the entire combination of structures and walls will add up to an effective whole.



A splayed facade will diffuse reflected sound.



Noise barriers must be solid and continuous to be effective.



Plantings should not exceed barrier height at maturity.

Figure 4.8

Noise Buffer Characteristics

Visual Buffer and Airport Edge. Massport should develop a continuous landscaped strip around its perimeter. The landscaped area should exist whether or not there are buildings at the perimeter, although its width will be reduced if there are buildings. This landscaped strip should include dense foliage to effectively screen the view of parking areas, service courts and any other unattractive airport service areas. The landscape design should not interfere with the noise attenuation effects of the noise barrier by diffusing noise reflected away from the community (see Summer Work Report). A serious commitment must be made to the maintenance of the landscaped area to insure its continued attractiveness.

The airport service building design guidelines will help to create a more attractive airport edge. Consistency of design style and color will make the edge visually less obtrusive. Buildings which are near the airport edge will be designed to be in scale, as far as possible, with adjacent buildings in the community. The functional requirements for the service area will result in vehicular circulation occurring on the airport-side of the service structures; this will benefit the community in terms of both noise and visual quality. Where parking lots abut the neighborhood they should be screened with opaque fencing and landscaping.

Recreational and Open Space Improvements. The opportunity exists to create new park areas at Jeffries Point if Massport's excess properties are returned to the community. This parkland would serve the local neighborhood, partially offset parkland lost to airport expansion in the past, and help to create a pleasant buffer between the BIF development and the community. Access to the East Boston athletic field should be improved with both safety and aesthetic issues resolved.

Summary

Airport/community edge conditions have been a source of concern to both residents and Massport for many years. The guidelines presented in this chapter offer the opportunity to resolve many of the problems. The major issue of airport related activities moving into the neighborhoods can only be resolved by a joint effort of the City of Boston, Massport and community residents. A task force should be set up to look at this problem and seek mutually satisfactory answers. Where specific Massport actions can significantly improve ground noise, traffic and visual problems, these actions should be undertaken.

Chapter 5

Growth and Environmental Issues

Air Travel Growth

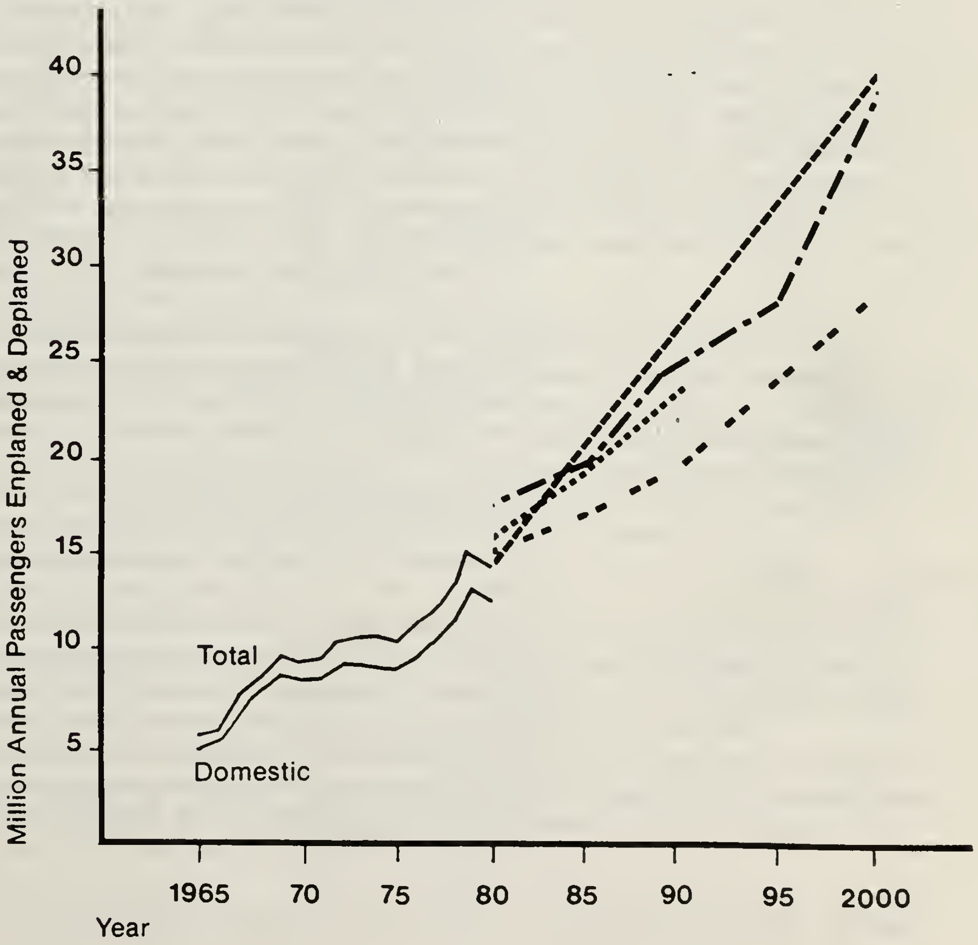
The most important factors in Logan Airport's future are growth in air travel and the characteristics of the industry that provide it. These factors are presently highly uncertain and should be monitored closely. While overinvestment is an obvious risk, underinvestment also poses risks to the quality of air transport serving Eastern Massachusetts.

Forecasts

Figure 5.1 depicts the growth in domestic and total passengers using Logan Airport each year since 1965. Forecasts from four sources are also shown; for the year 2000 they range between 194% and 261% of 1980 passenger volumes. Studies done for Massport by consultants show that increases of this magnitude can be handled by the present airfield through major shifts in the airline fleet mix to wide-body and larger standard body aircraft. As described later in this report, several major investments would be needed to handle passenger volumes of this magnitude, particularly to accommodate the increases in private automobiles implied by this growth.

Figure 5.1

Historical and Projected Growth at Logan Airport



Forecasts of air travel are historically unreliable. DeNeufville[1] has shown that half of the passenger forecasts sampled by him were incorrect by approximately 20%, only six years after they were made. Studies of the relationship of air travel demand to airline fares also diverge widely. The terminology used in forecasts includes implicit assumptions which may or may not be accurate: many forecasts are basically straight-line extensions of past growth; others imply an upward curvature by using annual growth rates that are compounded like interest. Critics of standard forecasts, on the other hand, assume that the air travel growth curve is S-shaped, curving upward in the industry's early years (through the 1960's) but later (the 1980's ?) increasing less each year until a plateau is reached.

Factors Influencing Growth at Logan

The demand for air travel is clearly influenced by the regional economy, by the price of travel, which is strongly related to energy costs, and by the need to travel.

New England's economy is presently strong and is based on industries with a bright future. New England's high-tech industries are strongly linked to center of finance and government and to markets throughout North America and Europe, so the need for business travel may grow. (Over 56% of the passengers surveyed in April 1979 who were beginning airline trips were travelling for business.) Since the population of the area served by Logan is expected to remain stable, the forecasts of Logan passengers imply more than twice as many trips per capita as today. However, business travel has an enormous impact on regional air travel: the median number of round trips per year by those who use Logan is three, but the average is over 12; this average is pulled up by travellers who make over 10 round-trips yearly (32%). Thus, there seems to be no reason why average number of trips cannot increase further if the number of business flyers increases. Conversely, a drop in the frequency of business travel would greatly reduce overall travel from Logan.

Fuel costs and availability will clearly have a strong influence on the future of air travel. Fuel costs are comparable to labor as a fraction of air transport industry costs, and in 1979 airlines cancelled some flights because fuel was simply unavailable. On the other hand, the fuel efficiency per seat-mile of large airliners is comparable to that for large automobiles, and there is no substitute for air travel for long trips where time is limited. Therefore, air travel may continue to be regarded as a high priority use for scarce energy. At the same time, more efficient aircraft and higher load factors may result as airlines adjust schedules and equipment to reduce energy costs.

An indirect result of higher energy costs may be a shortage of capital in the industry as airlines invest in new fleets of energy-efficient planes correctly sized for their route structures. Airlines with insufficient capital may not be able to finance terminals and other airport facilities without Massport assistance.

Deregulation has facilitated change in the air transport industry at the time when energy costs increased dramatically and the national economy turned down. Major changes have resulted, especially competition for major trunk routes and elimination of routes to minor markets. At Logan, neither effect has been extremely pronounced, but some shifts among carriers may occur. Delta and US Air have thrived during the early years of deregulation, partly because their fleets and route structures were well matched to cope with fuel cost increases. Piedmont is a small carrier that has grown rapidly using small, efficient aircraft (Boeing 737) to establish a route structure with little competition. New York Air has entered Boston to compete with Eastern's established and profitable shuttle. Contraction of unsuccessful route networks involving Boston is also a possibility.

TWA ticket counter.

The availability of facilities may be a crucial factor in airline competition at Logan; airlines with poor or overcrowded facilities may not be able to compete for contested routes with those which have better facilities. Convenience of schedules is also a crucial element in airline competition, making it difficult for Massport to persuade airlines to shift flights away from peak hours in order to reduce congestion on the airfield and roadways, and at terminals. If load factors also increase in response to cost control strategies, peak hour congestion may be further exacerbated.

Airline route strategies are influenced in part by the airline's present capital investments. Delta, Eastern, American, US Air and TWA all have major terminal leases and hangars at Logan; other carriers have much less commitment here. The availability of facilities is also a factor in the choice of Logan as a European gateway by US carriers who have other options for connecting domestic and international routes.

It therefore seems likely that facility negotiations with airport users will in the future involve difficult and complex issues. One may also speculate that Massport may have to take the initiative to providing adequate facilities in order to encourage the airlines as a group to provide the region with schedules that maximize convenience in terms of cities served, and frequency of service.

Ground Access

A second major factor in planning for Logan Airport is the problem of getting people to and from the airport. The survey of airline pasengers and employees conducted by Massport's ground transportation consultants in April 1979 puts this problem in perspective. Private automobiles were used to reach the airport by 45% of the enplaning passengers surveyed. Another 9% used rented cars and 16% used taxis. Thus, 71% of the passengers arrived in automobiles. Of the remainder, 5% used the MBTA, 7% used intercity bus or limousine, and the remaining 17% changed flights without leaving the airport. Among the private automobiles, nearly half were driven away after dropping off the passenger without parking; approximately 56% of the parked cars were parked for two hours or less. Cars parked for a longer period remained for an average of approximately 40 hours and account for roughly 90% of the occupied parking spaces and a similar fraction of total parking revenues.

Among employees, 88% arrived by private automobile. Employee automobiles account for 35% of the daily automobile traffic to Logan and 30% of the 8:00 morning peak hour traffic.

The problems posed by private automobile traffic include an apparent lack of cross-harbor capacity, serious environmental impacts, especially air pollution, and present or future lack of capacity in parking lots, garages and terminal areas.

The ground access problem has been apparent for several years. The 1975 Airport Master Plan Study considered this issue at length, and in 1976 the Massport Board adopted policies to encourage increased mass transit use.[2]

There are major obstacles to effecting a shift of any major share of the present automobile users to bus, limousine or rapid transit. Perhaps the greatest obstacle is the very diffuse pattern of trips to the airport. Downtown Boston is the major concentration, but less than 10% of the April, 1979 trips to the airport originated there. Evidently, a large proportion of business air trips, as well as most other trips, originate at the residence where the traveller lives or is staying. Thus, apart from the difficulty of having to make several transfers to reach the airport, the user of rapid transit is limited by the fraction of trips that originate in the areas served by rapid transit. Intercity bus and limousine use, on the other hand, has shown growth over the past decade and offers some promise in attracting the airport user whose trip begins outside Rte. 128. Cambridge Systematics has estimated that, given a maximum effort of encouraging bus and limousine use, remote parking lots, downtown bus-terminal, major improvements to the Blue Line and increased airport parking fees, up to 20% of present automobile users could be diverted to another mode. If a significant airport access toll were also instituted, diversion might reach 30%. Diversion of employee trips is estimated to be more difficult, and probably limited to 15%.

Cross-Harbor Capacity

The high growth forecast in annual airline passengers to a level in the year 2000 of 2.6 times the 1980 volume implies a similar increase in automobile traffic, perhaps reduced by a 20% diversion to public transportation modes.

The Callahan and Sumner Tunnels presently reach their peak hour capacity of 3100 vehicles per hour; further growth in traffic volumes requires peaks to spread into adjacent hours with capacity to spare. Traffic studies by the Authority's ground transportation consultant have estimated that if the 15,200 daily vehicles not related to the airport remain constant, the tunnels would reach absolute capacity (i.e., operate at full capacity for 17 hours a day) by 1990 at the forecast growth rate. A 20% diversion would extend this absolute threshold to 1995. The practical limit to capacity would be reached earlier because a 17-hour period of full tunnel use does not satisfy the travel needs reflected in present airline schedules. Tunnel congestion may also limit the attractiveness of public transportation modes which use the road. Central Artery capacity problems may also limit ground access to Logan.

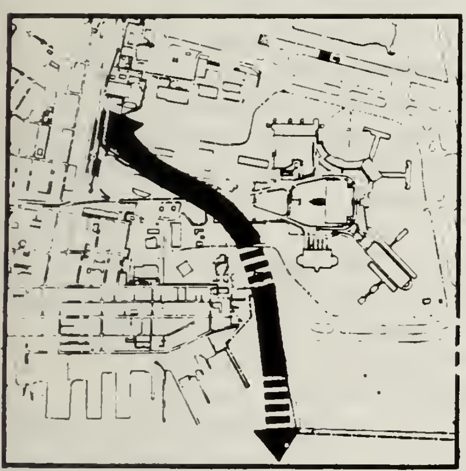


Figure 5.2

Cross Airport Alignment

The options that might deal with this problem are a shift in route to the Mystic Bridge, an increase in cross harbor capacity, or a more substantial shift to rapid transit than now appears likely. Use of the Mystic bridge and smaller bridges in Chelsea is not now considered promising by the traffic studies. However, environmental studies are being prepared on improvements to the Charles River Bridge. This is currently the major bottleneck in the bridge route to the airport. If these improvements are made and the alternate route is well marked and publicized, use of the Mystic Bridge route could be more attractive than it is now. This option should receive more study.

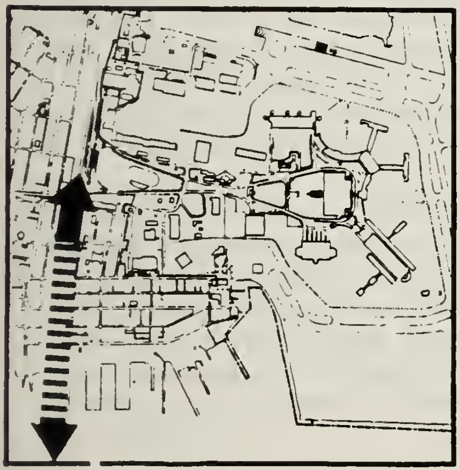


Figure 5.3

Off Airport Alignment

Third Harbor Crossing

▬ At Grade or Open Cut

|||||||| Decked Cut or Tunnel

A Third Harbor Crossing has been discussed for many years. At this time no alternative has been chosen for further study. The two basic alternatives are illustrated in Figures 5.2 and 5.3.

The third option for ground access is a radical shift to rapid transit access, at least during peak hours. Changes in driver attitudes would probably be necessary to bring this about, or perhaps intolerable peak period congestion. A shift to public transit would be facilitated by improvements to the Blue Line, especially cross-connection with the Red Line at Charles Street Station and perhaps extension of a spur into the airport from which passengers could reach the terminals on foot (Figure 5.4).

Because of the expense of such projects, the Blue Line spur and Third Harbor Tunnel would probably not both be built. Both projects involve risks of substantial overinvestment if forecasts of airport and other traffic or use turn out to be too high.

Environmental and Community Issues

Community concerns about Logan Airport are centered on environmental issues. In addition, deeply felt political attitudes have arisen owing to airport expansion and past episodes during which community interests were not seriously considered before major projects were undertaken. As a consequence, negotiation over matters such as land exchanges is often difficult because the community often regards concessions offered by Massport as insufficient to offset past debits which must be settled prior to discussing current proposals.

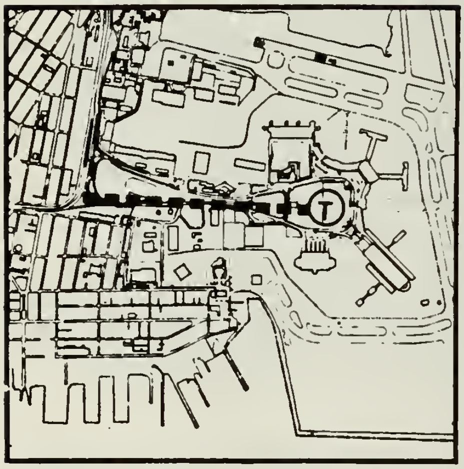


Figure 5.4
Potential Rapid Transit Spur

The environmental impacts caused by the airport are severe. Airport-related vehicular traffic is a significant contributuor to the degraded air quality in the airport environs. Aircraft fueling and exhaust results in unpleasant odors which are strongly evident in the community over much of the year. Aircraft operations cause severe noise impacts during takeoffs, landings, and taxiing. Automobile and truck noise is also a significant impact.

Noise in Jeffries Point and near the North apron presently exceeds 60 dB Ldn on an average annual basis. Analysis in the BIF Environmental Impact Statement[3] indicates average noise levels of 68 dB Ldn. In the community near the North Apron, the annual average noise levels are 73 dB Ldn, and under worst case conditions it is 79 dB Ldn. Flight operations are the dominant noise source in each case but ground operations contribute significantly to noise.

Air quality in East Boston and at the airport was monitored in connection with the BIF/EIR. One hour carbon monoxide levels in the terminal area and within approximately 1500 feet of the Callahan/Sumner tunnel toll plaza exceed 35 mg/m3, which is between the current Federal standard 40 mg/m3 and the proposed standard 29 mg/m3. Emissions per vehicle mile travelled are expected to drop significantly due to federal emission controls.

Hydrocarbon concentrations currently range from one-hour levels of 7 mg/m3 in the terminal area and North Apron to 5 mg/m3 near Day Square and 3 mg/m3 near Maverick Square. No hydrocarbon standard exists but a three-hour criterion was exceeded roughly 50% of the time near the airport edge.

Nitrogen oxide concentration range above one hour maximum of 2 mg/m3 near the terminals to 1.0 mg/m3 near Maverick Square and Day Square. These were estimated in the BIF/EIR to include NO_2 concentrations ranging from 0.24 mg/m3 to

0.39 mg/m3 in the community. The more stringent proposed federal standard is 0.47 mg/m3. This pollutant is expected to worsen as more efficient jet engines become more widely used.

Total suspended particulates (TSP) range from 24 hour concentrations of 0.2 mg/m3 in the terminal area to 0.07 mg/m3 near Maverick Square. The federal standard is 0.26 mg/m3. Aircraft TSP emissions are expected to decline as engine efficiencies improve. Diesel fueled vehicles which have higher TSP emission rates than gasoline powered vehicles may increase as a percentage of total traffic in the future.

If the forecast growth in airline passengers and cargo is realized, environmental impacts on the community would be likely to increase. The primary source of increased noise and air quality impacts would be the increased automobile and truck traffic implied by the forecasts. The extent of those impacts on Jeffries Point associated with air cargo development on BIF has been analyzed in the 1981 Environmental Impact Report on that project.

There are clearly major conflicts of interest regarding airport growth between the community, Massport, and the region served by Logan Airport. These conflicts of interest have no simple solution, but can perhaps be mitigated to some extent. The planning studies described in this report recognize the differences of interest and attempt to mitigate impacts, but this report does not claim to offer solutions acceptable to the community. Nonetheless, it is worthwhile to mention factors that may partially mitigate the impacts of growth.

Mitigating Factors

This report is not an environmental assessment of airport growth, but the following factors should nonetheless be mentioned.

First, it should be recognized that the forecast growth is not assured; measures such as a Third Harbor Crossing may not be necessary to keep the airport operating successfully. Automobile and truck emission controls are projected to partially offset the pollution caused by increased vehicle miles travelled. Some roadway improvements would also reduce total emissions by avoiding congestion which leads to increased automobile emissions.

The forecasts of passenger volumes assume increased use of wide body and new generation aircraft which are substantially quieter than the older aircraft now in use. The number of aricraft operations is not forecasted to increase substantially.

Much can be done to buffer the community edge from visual and traffic noise impacts. Land is not expected to be a serious constraint to airport growth, and Massport has the option of returning land to community-related uses.

Airport-related uses in the community cause problems which are not easily remedied, but Massport can cooperate in efforts to discourage such uses by providing incentives for alternate locations both on and off-airport and disincentives such as closing access points to the airport which encourage such uses to locate in the community.

Massport initiatives to divert airport users to multi-passenger vehicles are of mutual benefit to both the community and the airport.

Measures aimed at mitigation should be studied carefully to avoid unintended consequences. Parking limitations, such as the current freeze on parking spaces may increase rather than decrease airport traffic as intended if they encourage passenger drop-off and pick-up (two auto round-trips per air round-trip) as a substitute for long-term parking (one auto round-trip per air round-trip). Parking limitations may also encourage the growth of off-airport parking which may be less perferable to the community.

Footnotes

1. DeNeufville, Richard. Airport Systems Planning, MacMillan Press, Ltd., London, 1976, pp. 46-55.

2. Massachusetts Port Authority, Logan International Airport Master Plan, n.p., Boston,, 1976, pp. 46-58.

3. Massachusetts Port Authority, Revised Final Environmental Impact Report (for) Proposed Development of Bird Island Flats, n.p., Boston, April 30, 1981, p. 79 ff.

Table 6.1 Peak Hour Activity, August 1980[a]

Terminal/ Airline	Total Equiv. Operations		Arrivals			Departures	
	Time[b]	Pax[c]/hr	Time[b]	Pax/Hr	Pax/20 min.	Time[b]	Pax/Hr
Volpe	1800	1800	1400	833	585	1800	893
North	1800	2243	1800	1230	-	0900	1830
DL	0800	1433	0800	1035	1035	0900	1200
UA	0700	435	1700	323	188	0700	435
TW	2100	720	1700	338	240	2100	533
PI	0900	248	1900	165	83	0900	165
RC	Several	105		105	105		105
South:AA/NW	1740	1013	1700	803	-	1800	705
AA	0700	705	1700	405	300	0700	405
NW	1740	908	1740	503	405	1740	405
South:AL	0630	593	2100	300	225	0630	593
Southwest EA	0900	1013	1700	465	278	0900	668

[a] The figures in this table were estimated based on the Official Airline Guide Chronological Listing, assuming 75% load factor and average seating capacity for aircraft type.

[b] Time hour begins.

[c] Pax = Passengers

Chapter 6 Airline Passenger Terminals

The four terminals at Logan are the principal focus of activity at the airport and serve marketing and commercial functions as well as operational needs. The terminals have different characters and are perceived quite distinctly by airport users. Southwest Terminal is clearly identified as the home of Eastern Airlines and is a physical landmark at the airport. South Terminal has a functional image and is easy to use, but has no visual image as a distinct building; it is really seen from the inside out. North Terminal is quite similar in form to Southwest Terminal; however, the approach to the terminal cuts off views so that its landmark qualities cannot really be perceived. The three main airlines which are located in the terminal, Delta, TWA and United, have put their stamp on the terminal's interior, but the terminal is not perceived as "belonging" to any airline. Volpe Terminal houses many carriers each of which has little curb frontage and only small internal areas (largely ticket counters). The terminal building is distinctive and clearly visible as one approaches it and it acts as a landmark on the last leg of the terminal loop.

Design Criteria

The design criteria for the airport's terminals are primarily functional. The primary goal in planning for modifications or expansion of the terminals is to improve their capacity and circulation. The provision of clear and well-designed circulation from road to curb, road to parking, curb to parking and the reverse movements, as well as a safe and pleasant pedestrian circulation system will insure the efficient operation of the terminals. Logan's terminals are compact and therefore more convenient than the terminals at many large airports; however, the terminal system does not currently provide the circulation required for optimal operations. As described below, the lack of clear and direct connections between the curb and parking can add to curb congestion and driver confusion on the Terminal Loop Road. The various design options presented here for all the terminals address the circulation problems, and in most cases resolve them.

Overview

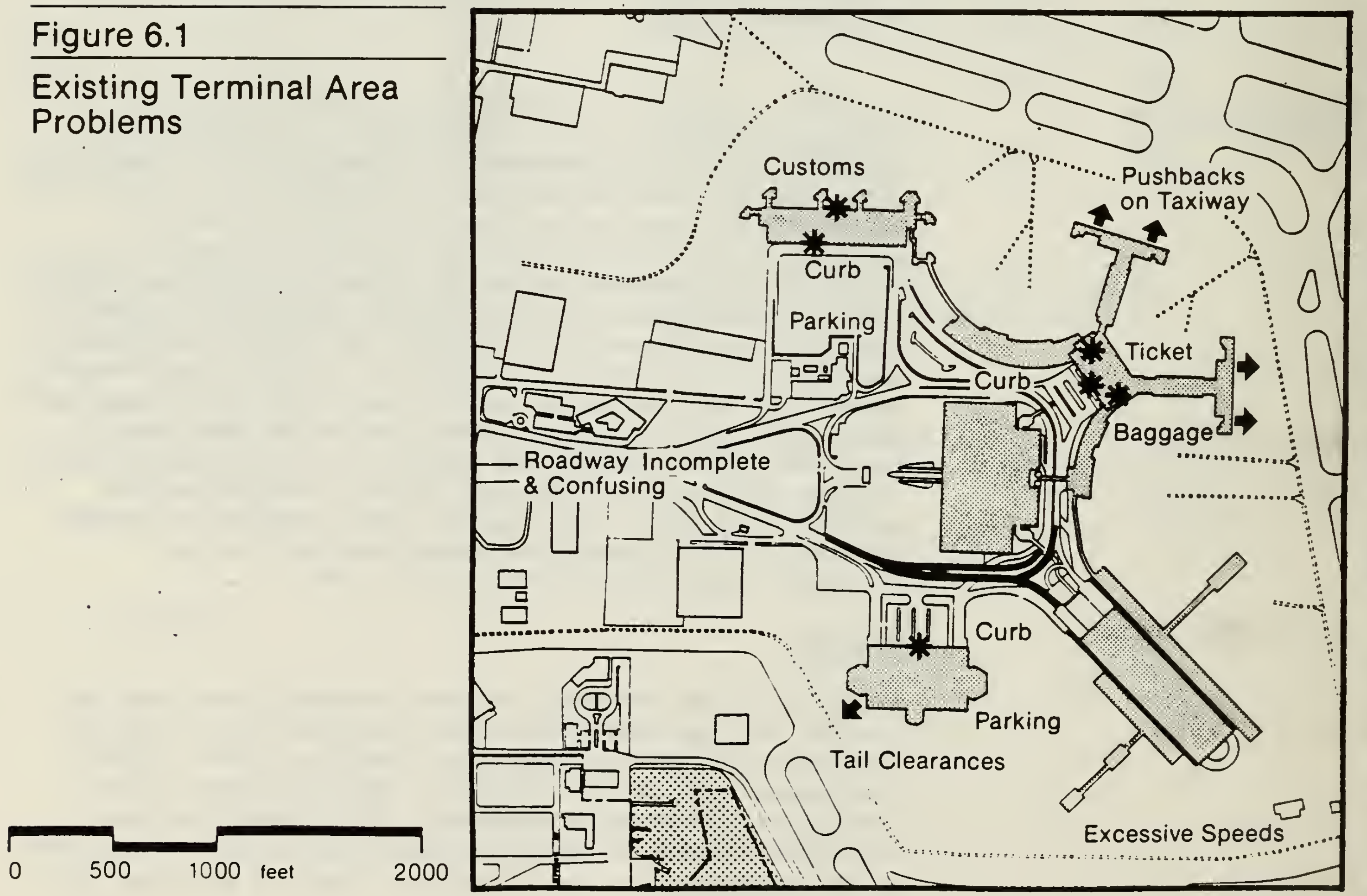
Activity at the terminals fluctuates widely from hour to hour as well as seasonally. Most functional and capacity problems occur during peak hours; parking demand, which fluctuates with daily rather than hourly volumes, is an exception to this generalization. This report follows standard practice in using the peak hour of the average day of the peak month as the indicative level of activity for most components.

Peak hour activity at each terminal is shown in Table 6.1. This table is the basis of the threshold analyses which appear below in the sections describing each terminal. The basic unit of activity used in the threshold analyses is passengers/hour or other unit of time. Peak hour load factors of 75% are assumed in this analysis. A 75% peak hour load factor was used to correspond with MPA forecasts where that factor is used in determining peak hour projections.

Existing Problems are shown in Figure 6.1. Notable deficiencies in capacity occur at the curbs of Southwest, North, and Volpe Terminals. Ticket lobby and baggage facilities are tight at North Terminal, and lobby and customs are congested at Volpe. Parking overflows are frequent at Southwest Terminal garage and were expected in summer 1981 at the Volpe lot. Design issues include the incomplete separation of the lower level and second level Terminal Roadway loops, which causes confusion and a high rate of missed terminal connections; excessive speeds owing to the long curb circulation at South Terminal; and less than desirable aircraft tail clearances between some

Figure 6.1

Existing Terminal Area Problems



Southwest and North Terminal gates and nearby taxiways. The latter design problems may not be susceptible to solution but should be borne in mind to avoid worsening the existing situations or repeating them elsewhere.

Critical Facility Thresholds are identified in Figure 6.2. The facilities shown there will be overloaded within the next 20 years if the forecasts of passenger growth are realized. Facilities with capacity less than 100% of 1980 August peak hour levels are also shown in the existing problems diagram above. The thresholds can be related to forecast growth by assuming growth of roughly 40% of 1980 activity levels each five years, a 160% increase by year 2000.

Figure 6.2

Critical Facility Thresholds

Facility capacities expressed as a percentage of August 1980 Activity Levels

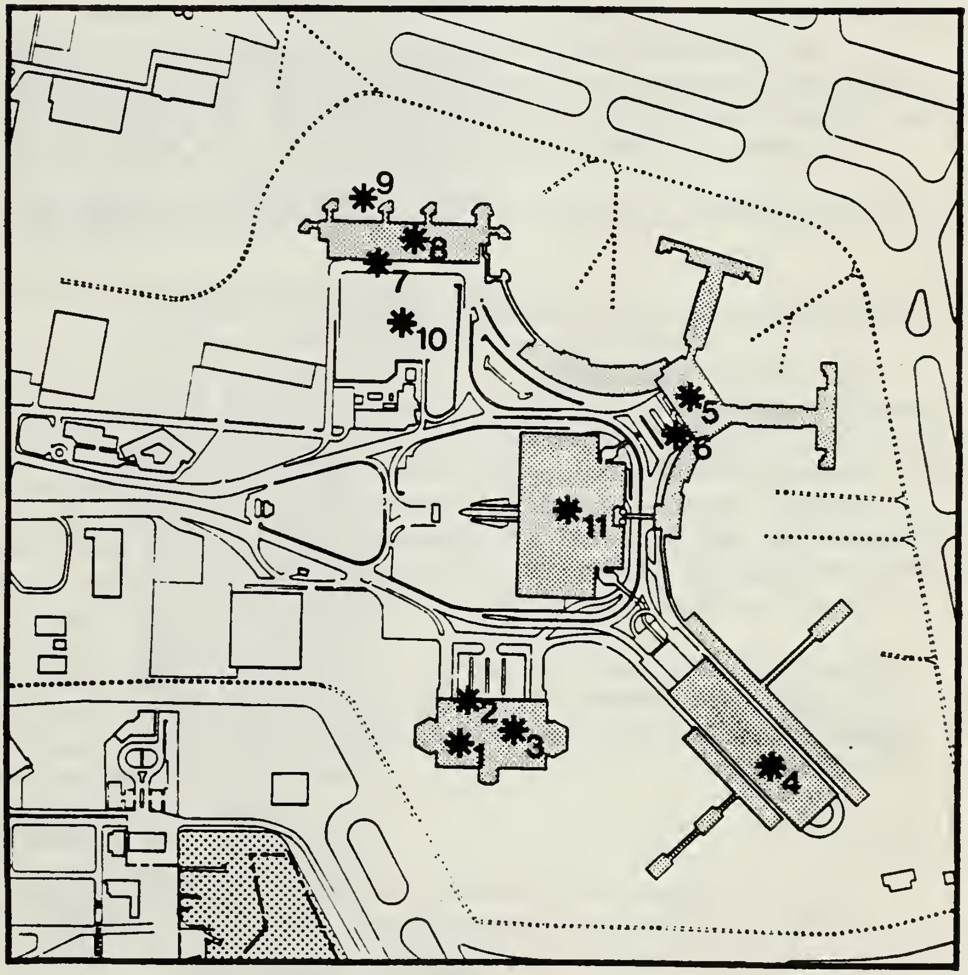
Southwest Terminal
1. Baggage Area 160%
2. Departure Curb 90%
3. Parking 87%

South Terminal
4. Parking 220%

North Terminal
5. Lobby/Baggage 56-100%
6. Departure Curb 87%

Volpe Terminal
7. Curb 67%
8. Customs 100%
9. Gates 130-150%
10. Parking 110%

Central Garage
11. Parking 170-200%



Component Facilities

The component parts of Logan's terminal facilities fall into three categories when they are examined to determine their capacities and their possibilities for expansion or renovation. These categories are gates, internal facilities (e.g. baggage rooms, counter space) and curb. The three are distinct for several reasons; their physical locations in the terminal are different, the difficulty and expense of adding to or modifying the facilities varies, and the responsibility for paying for and maintaining the facilities varies. Although the distinctions are not absolute, the following summary gives a basic idea of the terminal composition.

Gates

A threshold analysis of gate capacity for aircraft cannot be performed in the same manner that other facilities are evaluated. Two different factors make the use of a simple capacity measure uninformative. First, an increase in the number of gates implies an increase in operations during the peak hours; the airfield is already near capacity during peak hours, so this cannot occur. Second, gate demand depends on scheduling considerations which are too complex to predict.

A threshold analysis can, however, be done of the number of passengers that can be handled by existing gates, assuming the current mix of arrivals and departures and the largest aircraft that can be physically accommodated by the apron layout. Since the seating configuration of any particular aircraft may vary, thresholds will be a range.

The basic considerations for providing additional gates are as follows:

- The gates provide the passenger interface between airside and landside activities.
- Unless it is possible to reposition aircraft locations in order to add a gate, it is fairly expensive to add gates and impossible in many areas where taxiways limit the usable apron area. If a substantial number of gates were needed and new apron area required, it would be difficult to provide them at Logan without encroaching on cargo or hangar areas, and the additions would be costly.
- Minor modifications of gates would probably be done by the airlines; major terminal rebuilding would require MPA's participation.
- The number of gates that can be used at one time is related to the airfield capacity which is now fully utilized during several hours each month; proposals to add many more gates are constrained by this fact.

Internal Facilities

Three kinds of internal facilities were examined; ticket counter, baggage claim, and outbound baggage sorting area. The first two are used directly by passengers, the third is used by airline employees.

The threshold for any airline's ticket counter is imprecise because of differing ticketing procedures, pre-ticketing or check-in procedures. The proliferation of special fare tickets and division of planes into two, or sometimes three

Eastern Airlines ticket counter.

seating sections has increased the amount of time many passengers spend with a ticket agent. A key influence on the adequacy of an airline's check-in area is the size of the queuing area in front of and adjacent to the counter.

The thresholds calculated for the baggage claim frontage depend on the percentage of terminating versus transferring passengers. Both the linear frontage of claim device and the lobby area in front of it must be adequate in size. At Logan, input area for transfer of baggage from carts to the claim area is not generally a limiting factor in capacity, except where it interferes with the outbound baggage sorting. The baggage claim thresholds are based on the peak 20 minutes of arrivals. The 20 minute peaks are likely to fluctuate more than the peak hour.

The thresholds for outbound baggage areas assume an average amount of baggage per passenger. The percentage of transfer passengers and peak hour load factors also affect this threshold. International carriers do not usually sort bags, hence little outbound baggage room is needed.

The basic characteristics of the internal facilities are as follows:

- Located within the terminal building and usually equipped separately by each airline.
- If small additions are required and total floor area needed is modest, changes can be accomplished fairly simply and inexpensively through interior remodeling and minor expansion onto the apron. If there are more substantial space needs (several facilities or several airlines) it may be necessary to rebuild a major portion of the terminal or add major additions; this would be costly and require careful staging.
- The airlines themselves are generally responsible for the costs of interior renovations. Where a more major addition is required, MPA would become involved.

Curb

North Terminal curb.

The curb is the interface between the roadway and the terminal. It is the transfer point to and from ground transportation and is used by private autos, taxis, limousines, intercity buses, car rental shuttles, the Massport shuttle, and delivery and other service vehicles. Because the Terminal Roadway does not connect all terminals at the second level, buses and limousines generally use only the lower, arrival level curb. Although the provision of bus stops on the upper level might encourage a mode shift to public transportation, it will in the short term increase congestion and reduce the capacity at upper level curbs. Thresholds have been calculated with a section of the upper level curb assigned to buses.

Curb capacity is strongly influenced by the amount of time each vehicle stays at the curb. With a rapid turnover time, most of Logan's curbs would have adequate or more than adequate capacity. With present long turnover times the curbs are inadequate at both North and Volpe Terminals. Taxis and shuttles tend to stop at the curb fairly briefly (except where there are layover locations).

The length of time which private autos stay at the curb is influenced by several factors. The convenience of check-in will affect layover time, with rapid check-in and curbside check-in shortening layover time. The availability of curbside flight information screens will reduce the number of people who park at the curb to check flight arrival or departure times. The congestion at the long curbs at Volpe and South Terminals occurs in clumps around entrances serving the particular airline which is busy.

The management of the curb can greatly increase its capacity. If police are assigned to monitor the curb and prevent drivers from leaving their cars unattended, the total number of cars which can be accommodated will increase substantially over existing levels. Regular ticketing and towing of unattended cars is needed to discourage parking at the curb.

Most important to the reduction of curbside parking is the provision of convenient and simple connections between the curb and parking. Where adequate short-term parking is available near the curb, people can be much more successfully induced not to park at the curb. Each of the terminal options described later in this chapter directly addresses this issue.

Vehicle use per passenger varies from terminal to terminal, this may shift over time. Therefore, the vehicle/passenger ratio at each terminal should be updated occasionally to insure the accuracy of threshold calculations.

Observation of the terminal curbs suggests that roughly the same number of cars can use the curbs at one time in either of two ways: single parked at terminal-side and at the opposite curb with through lanes between them, or double parked at the terminal-side curb with through lanes at the opposite curb. Traffic at North Terminal's curb was observed to shift spontaneously between these two patterns, double parking being the prevalent mode. Estimates of curb availability should thus include the length of opposite curb to give a realistic measure of usable capacity.

Curb Management Options. A number of management policies and physical changes exist which could increase curb capacity. The following list outlines a variety of options.

1. Policing of dwell times at terminal curbs should strictly prohibit drivers from leaving their cars.

Since terminals fluctuate between periods of heavy use and periods of no activity, parking restrictions must be enforced during lulls as well as busy hours.

2. Curbside monitors, now used at South Terminal, should be installed where lacking so that drivers need not leave their cars to check arrival times.

3. Car rental shuttles should be more strictly regulated. They should be limited to designated curb areas and shuttle trips should be consolidated; this could be accomplished by a number of means, including providing Massport service for all car rental firms or by requiring the car rental shuttles to act as "common carriers" during busy periods,each firm providing service to other firms' customers as well as its own. Although any reduction of shuttle use would be opposed by the car rental firms, the latter method might be more readily accepted than the former because firm images would be maintained. It would provide an opportunity for orderly service competition based on courteous treatment of customers, rather than duplication of service which increases traffic while providing only marginal improvements in service levels.

4. Curb areas should be reserved for use by buses, limousines, shuttles, and taxis. It is now provided at North Terminal but lacking at South and Volpe.

5. Traffic direction should be used to prevent blockage of through lanes causing inefficient use of curb space downstream from the most frequently used terminal entrances. Double parking is permissible if properly directed and if drivers may not leave their cars unattended.

6. Cross utilization of arrival and departure curbs can make better use of vacant curb on the level that is less busy at a given time. It may be difficult to inform the drivers of private automobiles, but taxis, limousines and shuttles can be informed by radio or activated sign at the airport entrance as to which curb level to use. After claiming baggage, passengers could be directed to the appropriate level.

7. Better connections between terminals and short term parking will reduce curbside drop-offs, particularly if baggage may be checked or collected remote from the terminal. Baggage conveyers parallel to the walkways to and from central parking areas would induce some travellers to forego use of the curbs. Even simple baggage carts made available on the same basis as supermarket shopping carts might be considered if the path from parking to the terminal lobby can be made barrier-free.

8. Layover space for buses and limousines should be provided in a central location, such as the ready-car lot, and these vehicles should be prohibited from laying over at the terminal curb during periods of congestion.

An increase in curb capacity can be achieved with some or many of these tools. Other than management changes alone, most additions to the curb are fairly expensive and require some detour of traffic. Massport is generally responsible for planning, designing and financing changes in curb configuration.

Terminal Options

For each terminal, existing conditions are described and threshold analyses for major components are presented. Options for improvement of each terminal are described and evaluated in the section on that terminal.

Thresholds which have been identified for the terminals and airlines have helped to identify the facility requirements at each terminal. The methodology for determining the thresholds is described in the Appendix. The thresholds are approximate indicators of undesireable levels of congestion; several facilities currently operate beyond their thresholds. Threshold estimates depend on a variety of assumptions about how a facility is used. For example, peak hour load factors, bags checked per passenger, and percentage of transfer passengers all influence the threshold for baggage handling facilities. Therefore, the thresholds are not precise. Rather, they indicate that within a range of about 15% above or below the threshold, the facility is likely to be operating at a reasonable level of use. The thresholds identified in this chapter should be interpreted with this 15% margin in mind.

The thresholds have been calculated for peak hour on an average day in the peak month (August). This is the standard design hour used in the FAA's Terminal Design Manual. In some cases the peak month and average month are not very different (Eastern Airlines and Southwest Terminal), while in others (Volpe and most international carriers) the peak month may carry almost twice as many passengers as the average. Because of these variations, the terminals must be built to operate at different year-round efficiencies. Southwest Terminal will operate at roughly the same volume all year, while Volpe will be underutilized during the winter if it is adequate to handle the summer peaks. Thus, peak period congestion at Volpe may be an acceptable price to pay for fuller year-round utilization.

The passenger load factor has been assumed to be 75% for the threshold analysis. This load factor may change over time and may also vary between peak and non-peak hours. Peak hour load factors should be checked periodically to insure the accuracy of the threshold analyses.

Options for expansion have been identified for each of the terminals. Each of them is illustrated and a brief description covers their most important design features. Following the descriptions of the options for each terminal is a chart summarizing the options. Investment packages for the entire airport (Chapter 3) are composed of terminal options selected from those described here.

The terminal improvement options reflect conceptual planning studies of each terminal at intermediate scale (1"=100'). The options are based on standard conceptual layouts of terminal building, apron, and curb circulation (Figures 6.3, 6.4 and 6.5). The concepts have been modified as appropriate for the specific conditions at each terminal. The layouts are based on FAA guidelines and conceptual studies of the functional organization of terminal floor areas.

The design of curb space has been standardized in the terminal options which follow, and Figure 6.5 gives the dimensions of the curb and roadway. The design allows for three curb lanes. The width of the roadway is ample to allow some flexibility in use so that double parking at the inside curb (closest to the terminal) will not obstruct the flow of traffic. Each of the options addresses the question of access between the curb and parking, each option simplifies this movement and obviates the necessity of getting onto the main Terminal Roadway to go between the curb and parking.

A discussion of the compatibility of the terminal options with each other and with the roadway options can be found in Chapter 10.

The cost estimates for each of the options include design costs but do not include relocation or detour costs. The unit prices used in calculating costs are in 1981 dollars and are as follows:

Terminal	New, No special staging	$100/SF
	New, Special staging	$150/SF
Garage	Standard, 5 floors	$12,000/space
	Over Roadway, 3 floors	$15,000/space
Roadway	Upper Level	$100/SF
	At Grade	$5.50/SF
Ramps	Roadway Ramps	$120/SF

These estimates are intended only to indicate relative, order of magnitude costs.

Figure 6.3

International Terminal Site Layout

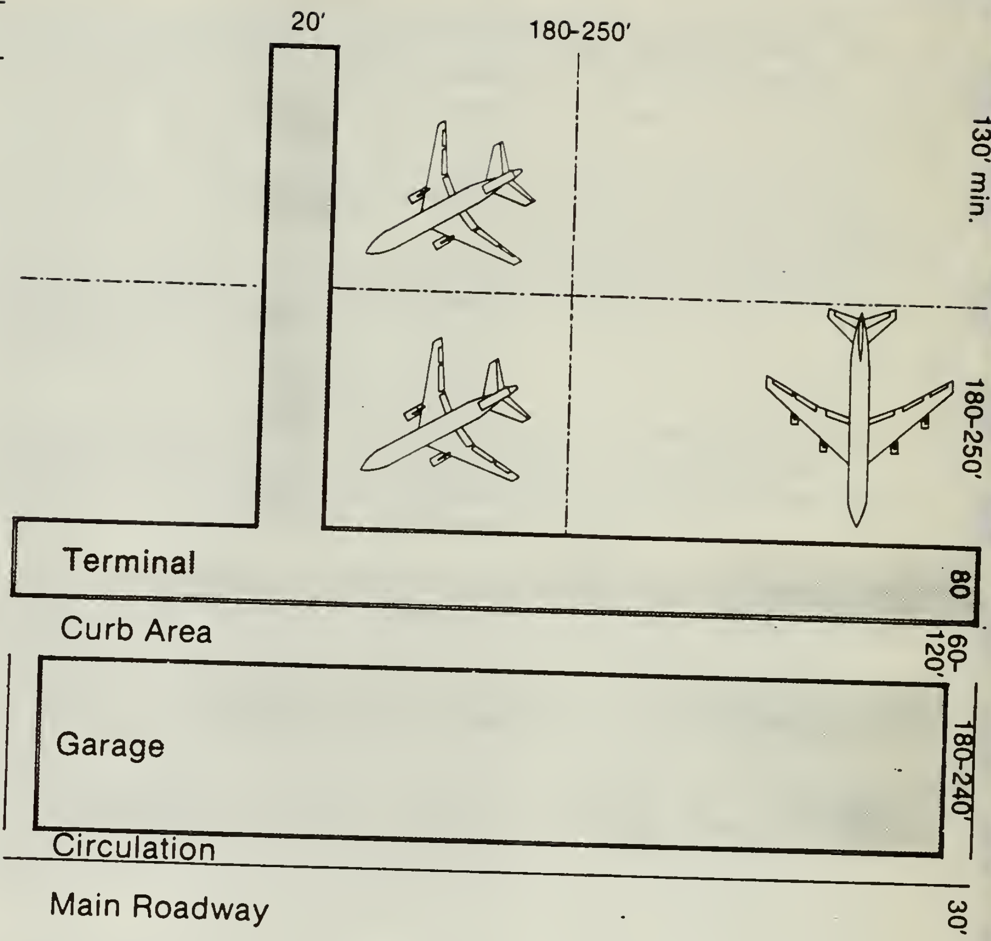


Figure 6.4

Domestic Pier/Linear Terminal Site Layout

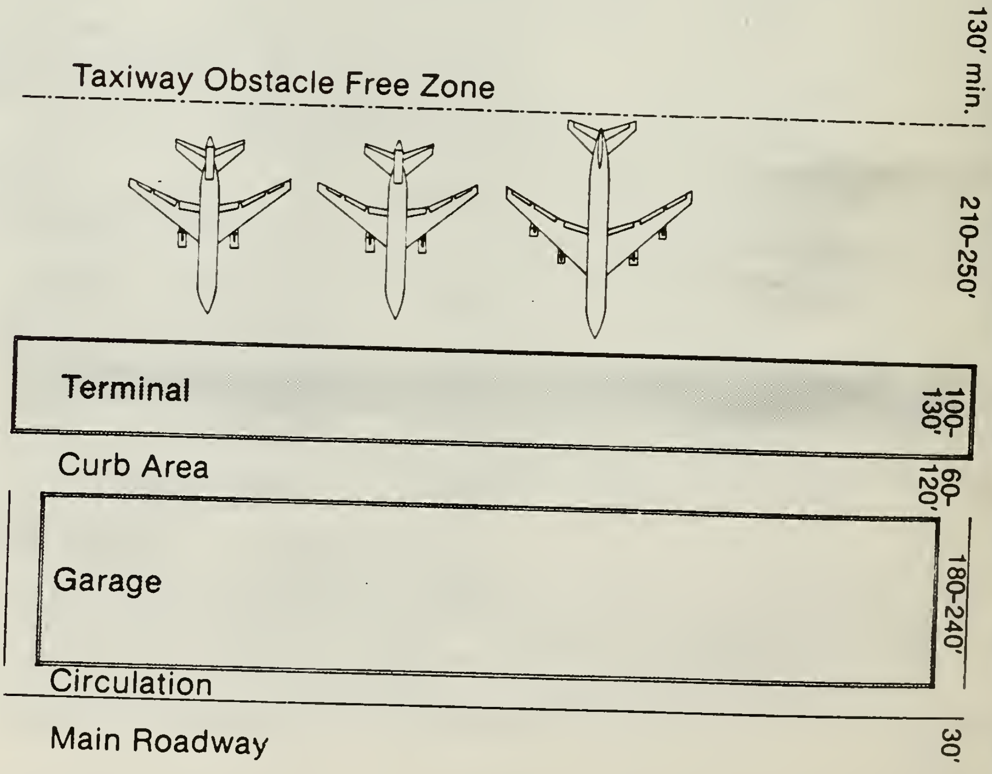
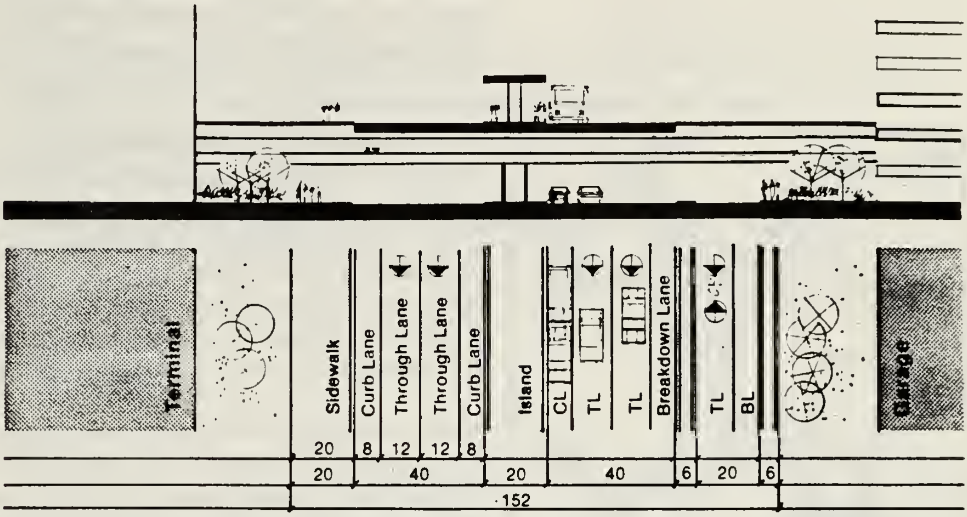


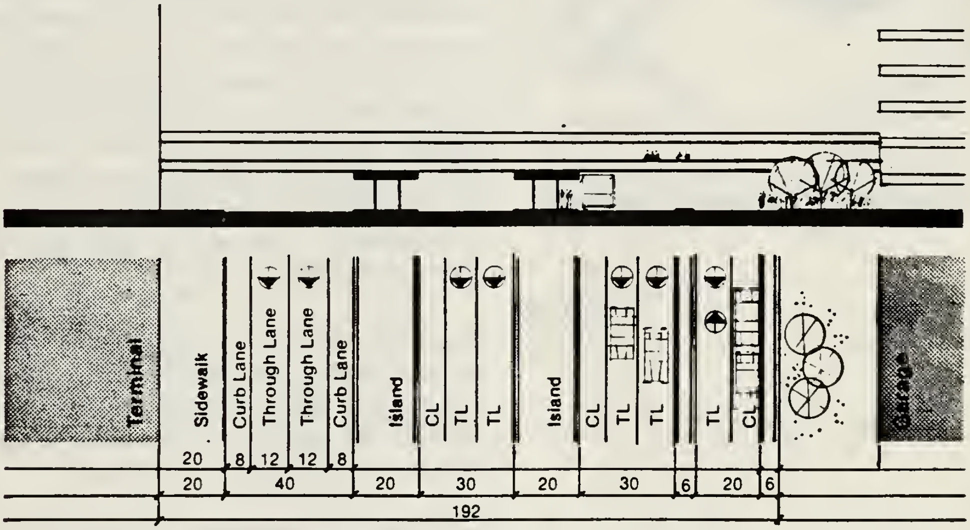
Figure 6.5

Plan and Section at Terminal Curb

Two Level Curb



One Level Curb



Southwest Terminal

Eastern Airlines is the prime tenant of Southwest Terminal. Three commuter carriers, Bar Harbor, Precision Air and Provincetown-Boston Airlines, use Gates 13 and 14. During an average day in August (the airport's peak month) approximately 1,000 people arrive at or depart from Eastern Airlines gates during the peak hour.

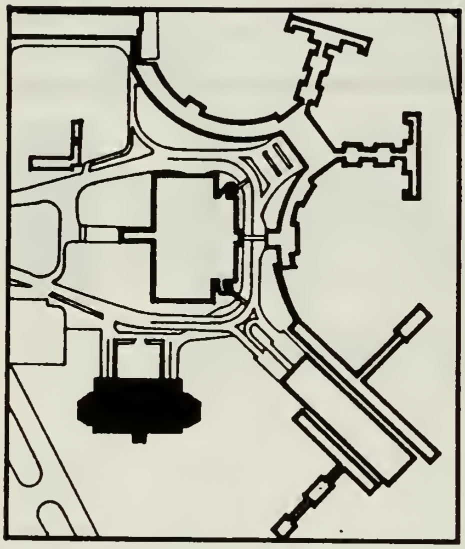


Figure 6.6
Southwest Terminal Location

The terminal circulation is well designed and there is easy access between the curb and both short- and long-term parking. The short ramps which lead to the upper level curb are accessible from a two-way road which runs the length of the at-grade parking lot. This configuraton allows a driver to move between the upper and lower levels. A parking garage within the terminal building is accessible from the upper level curb.

The threshold analysis confirmed that demand for the in-terminal garage is perhaps 10 to 15% beyond its capacity. Overflow parking uses the Central Garage. Vehicular circulation between Southwest Terminal and the Central Garage is circuitous and inconvenient, and the pedestrian connection is poorly marked and has several barriers to wheelchairs and suitcase dollies. The departure curb is beyond its threshold. Ticket counter and outbound baggage handling area are approaching their thresholds but still have some leeway, particularly if management techniques are used to increase their efficiency. Massport has plans to add a commuter pier to the terminal.

The two main goals of the terminal improvement options are to provide a direct vehicular connection between the terminal garage and the Central Garage and to increase the amount of upper level curb space. Both of these goals are met in all of the options.

One design question arises at Southwest Terminal in relation to the possible relocation of the Terminal Roadway Loop up-ramp. In order to simplify the decision points on the Terminal Loop it is desirable to split the entire loop into an arrival and a departure level. This split would occur several hundred feet before the exit to Southwest Terminal. However, if the departure and arrival levels of Southwest Terminal are split prior to arriving at the terminal, the easy circulation between the upper and lower levels will be disrupted. This is important at Southwest Terminal because the only entrance to the parking garage is on the second level and the only exit at the lower level. In order to make the terminal function properly, direct access from the arrival level to the parking garage must be maintained either by adding an entrance to the garage on the lower level or by maintaining easy access between the upper and lower levels.

Figure 6.7

Southwest Terminal Facility Thresholds

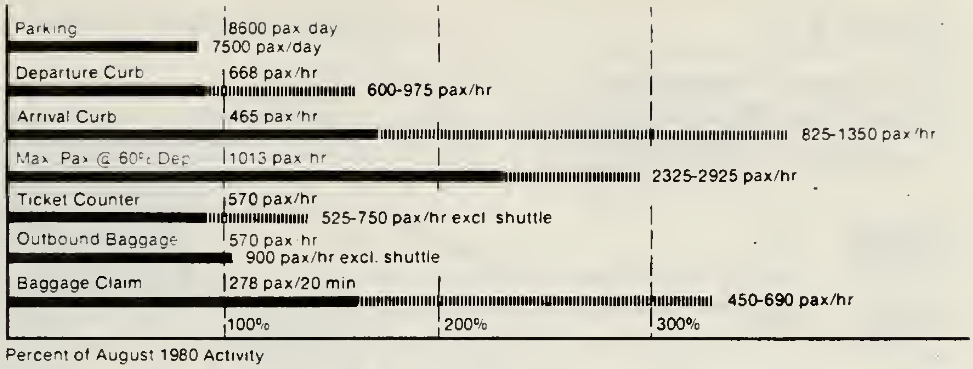


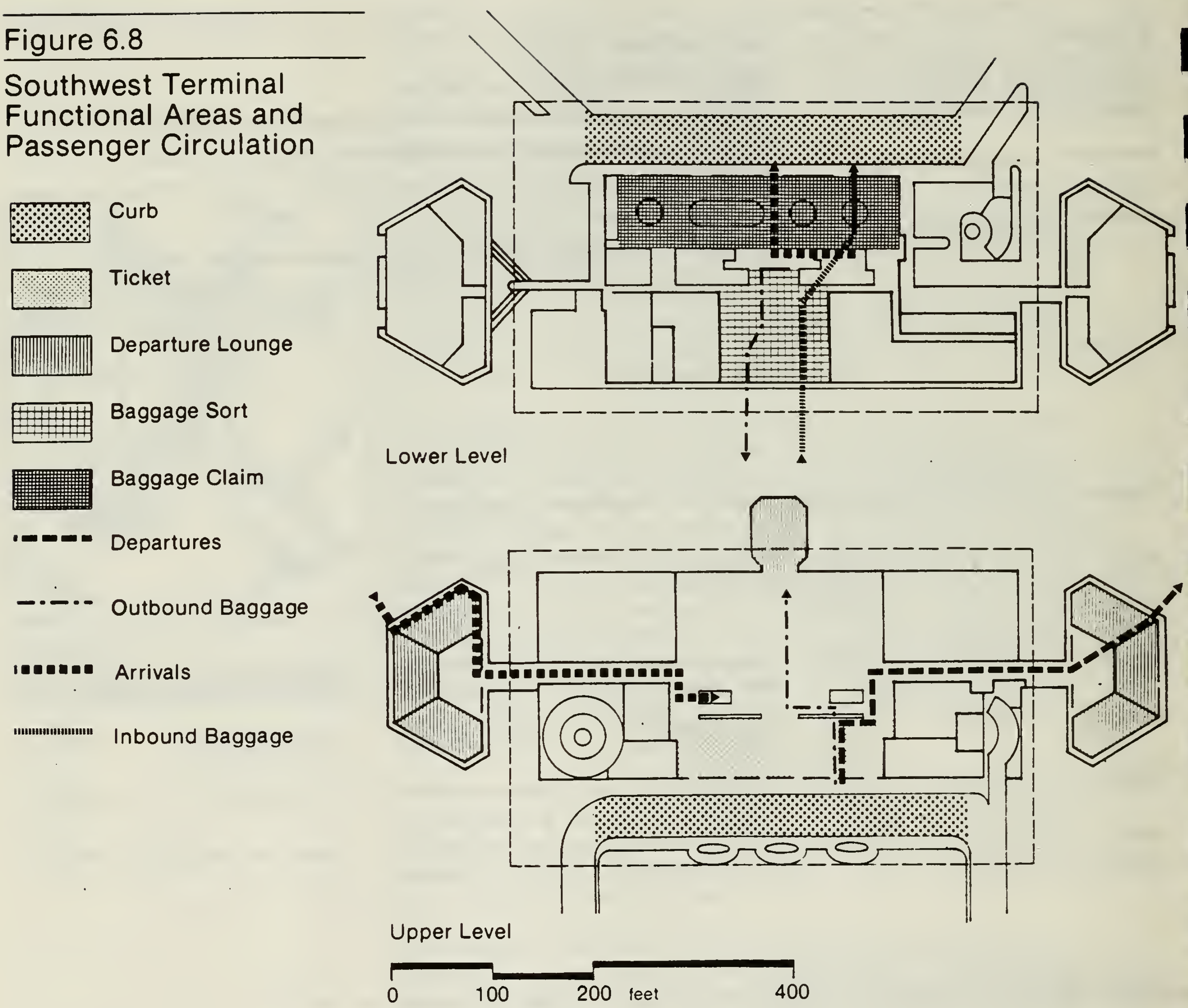
Table 6.2 Option Evaluation Summary, Southwest Terminal

Terminal Option	% of Program Provided			Circulation Characteristics	Takings	Staging	Estimated Cost
	Gates	Curb	Adjacent Parking				
Option 1	150%	100%	50%[a]	Direct connections for all movements	MPA Taxi Pools	Roadway detour and construction above road	$26 m
Option 2	150%	100%	40%[a]	Direct connections for all movements	MPA Taxi Pools	Less construction above roadwav	$21 m
Option 3	150%	100%	50%[a]	Direct connections for all movement	MPA Taxi Pools	As in Option 1	$33 m
Option 4	150%	310%	55%	Direct connections for all movements	MPA Taxi Pools	Major and Complicated	$96 m

[a] Direct vehicular connections to and from Central Garage provide the remainder of parking.

Figure 6.8

Southwest Terminal Functional Areas and Passenger Circulation



SOUTHWEST TERMINAL: OPTION 1

DESCRIPTION

This option includes an added curb island at the upper level and modification of lower level circulation. A garage connects the existing in-terminal garage with the central garage at the third level. The terminal itself is unchanged.

RELATIONSHIP TO DESIGN PROGRAM

Gates ample for projected use. Curb meets program requirement. Parking falls short by 2000 spaces but connection to central garage allows requirement to be met there.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	Good connection, some pedestrians must cross several lanes of traffic.
Parking to Lobby:	Good connection, maximum distance from terminal garage to lobby is 700'.
Lobby to Gate:	Good connection.

Vehicular

Entrance to Curb:	Direct
Curb to Parking:	Direct
Parking to Curb:	Direct
Curb to Exit:	Direct
Entrance to Parking:	Direct
Parking to Exit:	Direct

COST (ORDER OF MAGNITUDE)

Garage	$18.0 M
Roadway & Curb	5.9 M
Ramp	2.5 M
	$26.4 M

STAGING IMPLICATIONS

Significant but not major: new ramp into Southwest Terminal will require detour with Southwest and some disruption of Main Road. Garage over road will require special construction methods.

TAKINGS

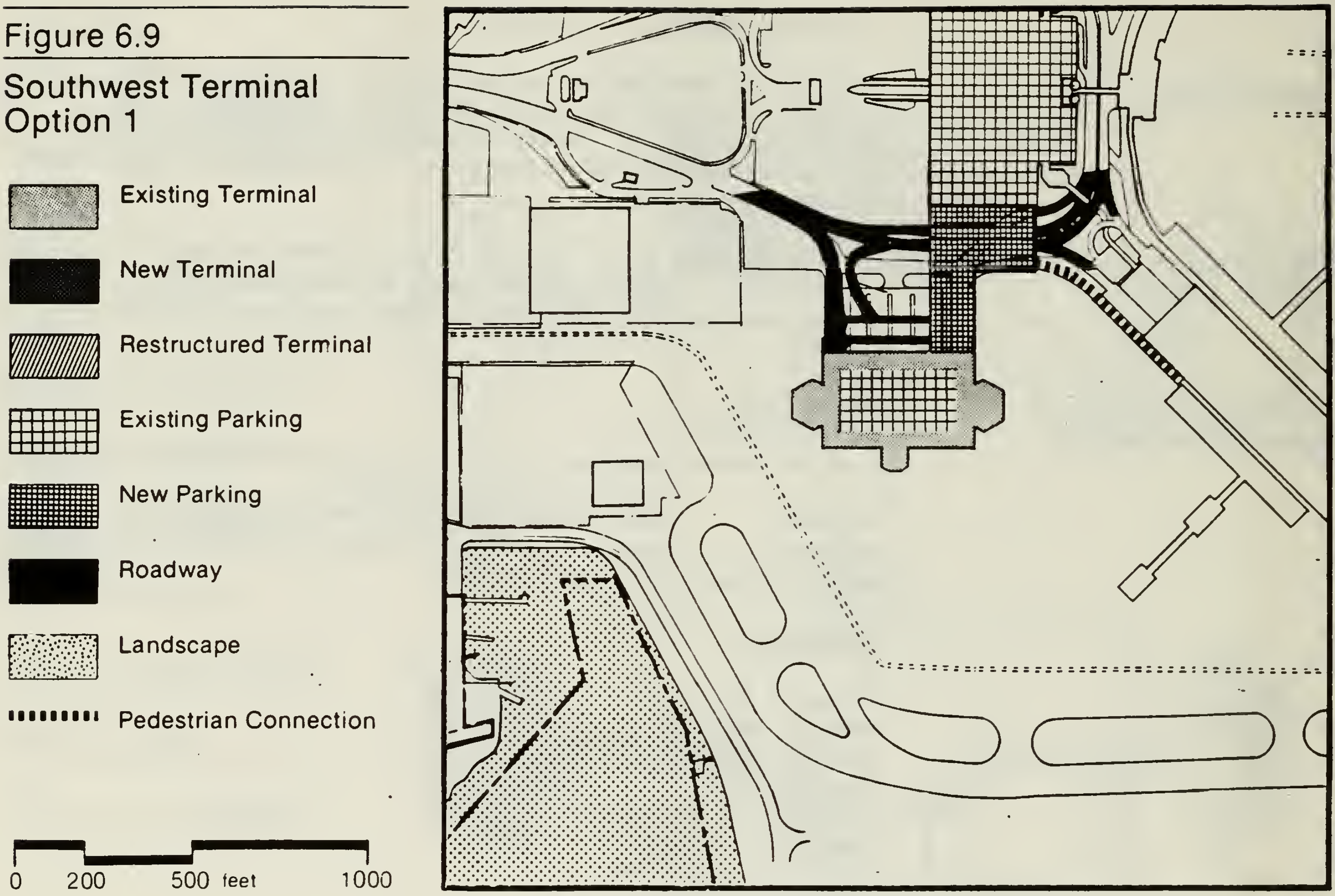
Parts of both Massport taxi pools are taken by the proposed new ramp on the Main Loop.

COMMENTS

This option expands upper level curb capacity and thus allows upper level use by buses and limousines. Use of the existing upper level curb for buses will become increasingly difficult owing to congestion. (A connection permitting second level bus use is assumed to be implemented immediately.)

Figure 6.9

Southwest Terminal Option 1



New Floor Area: None

Restructured Floor Area: None

Gates: 12 Existing
0 New
12 Total

Curb Length: 1200' Upper
1200' Lower
2400' Total

Parking Spaces: 1150 Existing
1200 New
2350 Total

SOUTHWEST TERMINAL: OPTION 1a

DESCRIPTION	Option 1a is exactly like Option 1 except that the connection between the terminal garage and the Central Garage is only a bridge; no parking spaces are constructed over the roadway.
RELATIONSHIP TO DESIGN PROGRAM	Gates ample for projected use. Curb meets program requirement. Parking falls short by 3200 spaces but connection to Central Garage allows requirement to be met there.
FUNCTIONAL & SERVICE QUALITY EVALUATION	See Option 1
COST (ORDER OF MAGNITUDE)	Roadway and Curb $5.9 M Ramp 2.5 M Bridge to Central Garage 2.4 M 10.8 M
STAGING IMPLICATIONS	See Option 1
TAKINGS	See Option 1
COMMENTS	See Option 1

SOUTHWEST TERMINAL: OPTION 2

DESCRIPTION

This option would build a garage in front of the terminal over the existing short term parking lot. Additional curb space would be constructed on the upper and lower levels.

RELATIONSHIP TO DESIGN PROGRAM

Gates more than ample. Curb meets program requirement. Parking falls 2600 spaces short but connection to central garage allows this to be met there.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby: See Option 1
Parking to Lobby: Maximum distance terminal garage to lobby 400'.
Lobby to Gate: See Option 1

Vehicular

Entrance to Curb: See Option 1
Curb to Parking: See Option 1
Parking to Curb: See Option 1
Curb to Exit: See Option 1
Entrance to Parking: See Option 1
Parking to Exit: See Option 1

COST (ORDER OF MAGNITUDE)

Garage	$12.8 M
Roadway	5.9 M
Ramp	2.5 M
	$21.2 M

STAGING IMPLICATIONS

Similar to Option 1, but garage construction is less difficult.

TAKINGS

Parts of both Massport Taxi Pools are taken by the proposed new ramp on the main loop.

COMMENTS

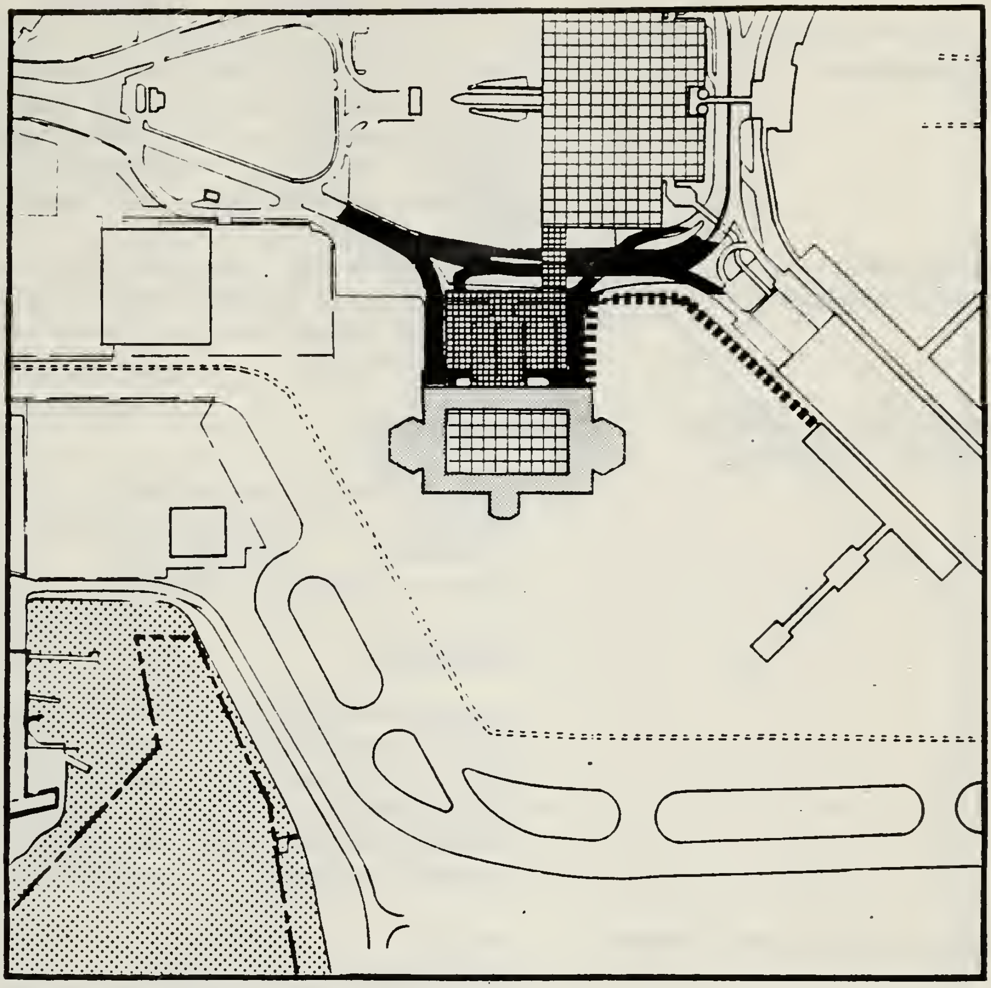
Same as Option 1.

Figure 6.10

Southwest Terminal Option 2

- ▭ Existing Terminal
- ▩ New Terminal
- ▨ Restructured Terminal
- ▦ Existing Parking
- ▩ New Parking
- ■ Roadway
- ░ Landscape
- ▮▮▮▮▮▮▮▮▮ Pedestrian Connection

0 200 500 feet 1000



New Floor Area: None

Restructured Floor Area: None

Gates: 12 Existing
0 New
12 Total

Curb Length: 1200' Upper
1200' Lower
2400' Total

Parking Spaces: 1150 Existing
850 New
2000 Total

SOUTHWEST TERMINAL: OPTION 3

DESCRIPTION

This option includes a new garage in front of the terminal above the curb and existing short-term parking area. The garage extends over the main roadway and abuts the central garage. Additional curb space is added in front of the terminal at both upper and lower levels.

RELATIONSHIP TO DESIGN PROGRAM

Gates ample for projected use. Curb more than meets program requirement. Parking spaces fall 1460 short of projected need but connection to central garage allows requirement to be met there.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	See Option 1
Parking to Lobby:	Good connection, walk from furthest end of garage 800'.
Lobby to Gate:	See Option 1

Vehicular

Entrance to Curb:	See Option 1
Curb to Parking:	See Option 1
Parking to Curb:	See Option 1
Curb to Exit:	See Option 1
Entrance to Parking:	See Option 1
Parking to Exit:	See Option 1

COST (ORDER OF MAGNITUDE)

Garage	$27.0 M
Curb & Roadway	5.9 M
	$32.9 M

STAGING IMPLICATIONS

Constructon of new curb and garage will disrupt Southwest Terminal operations. New ramp and garage over loop road will require special staging and construction.

TAKINGS

Same as Option 1.

COMMENTS

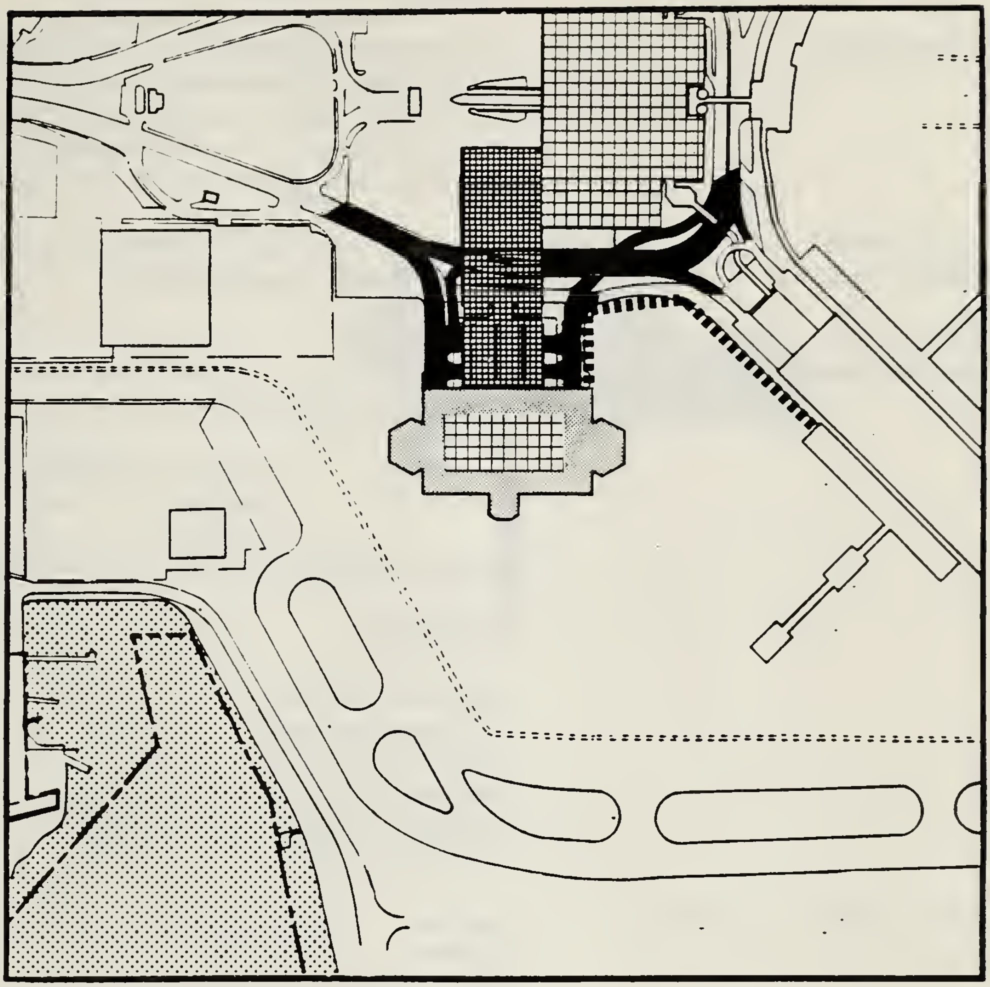
Same as Option 1.

Figure 6.11

Southwest Terminal Option 3

- ☐ Existing Terminal
- ▩ New Terminal
- ▨ Restructured Terminal
- ▦ Existing Parking
- ▩ New Parking
- ■ Roadway
- ░ Landscape
- ▮▮▮▮▮▮▮▮▮ Pedestrian Connection

0 200 500 feet 1000



New Floor Area: None

Restructured Floor Area: None

Gates: 12 Existing
0 New
12 Total

Curb Length: 1200' Upper
1200' Lower
2400' Total

Parking Spaces: 1150 Existing
2000 New
3150 Total (Note that 1000 of these are in the central parking area.)

SOUTHWEST TERMINAL: OPTION 4

DESCRIPTION

New Southwest Terminal. This option includes the complete rebuilding of Southwest Terminal. The new terminal is a linear building running along the apron and connecting to South Terminal. A new garage is built in front of the terminal and connects to the central garage.

RELATIONSHIP TO DESIGN PROGRAM

2000 parking spaces short of program, ample gate capacity, curb exceeds requirement.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby: Direct
Parking to Lobby: Direct, maximum distance from Terminal garage 350', walk from central garage is longer.
Lobby to Gate: Direct, longest walk 700'

Vehicular

Entrance to Curb: Direct
Curb to Parking: Direct
Parking to Curb: Direct
Curb to Exit: Direct
Entrance to Parking: Direct
Parking to Exit: Direct

COST (ORDER OF MAGNITUDE)

Terminal	$43.0 M	(at $150 SF)
Garage	33.0 M	
Road & Curb	17.0 M	
Ramp	2.5 M	
	$95.5 M	

STAGING IMPLICATIONS

Major difficulties, current operations in Southwest Terminal would have to be relocated. Minor staging difficulties on loop road for ramp and garage construction.

TAKINGS

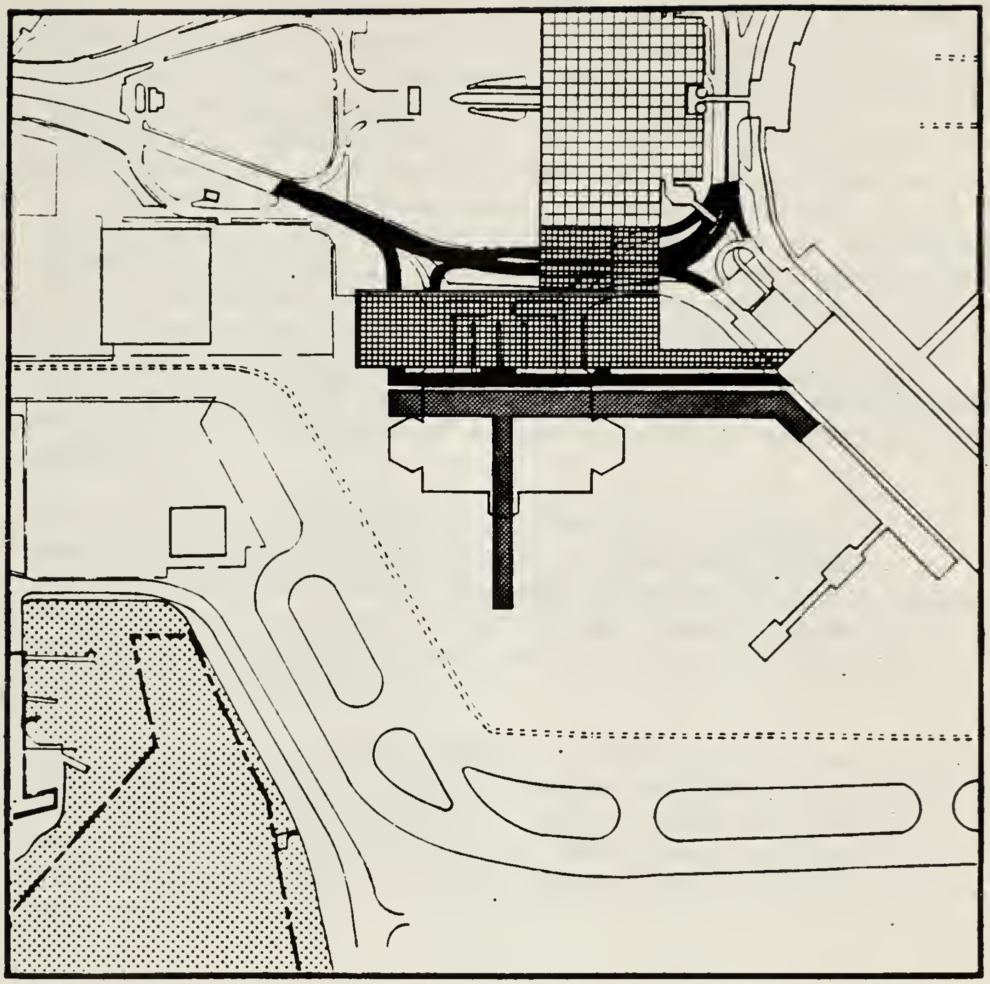
Parts of both Massport Taxi Pools are taken by the proposed new ramp on the main loop.

COMMENTS

Gate configuration improved; there is more than ample curb space provided.

Figure 6.12

Southwest Terminal Option 4



New Floor Area: 288,000 SF on two levels

Restructured Floor Area: None

Gates: 12 Existing
12 New (replace 12 existing)
12 Total

Curb Length: 3750' Upper
3750' Lower
7500' Total

Parking Spaces: 0 Existing
2600 New
2600 Total

South Terminal

South Terminal is Logan's newest terminal and houses the certificated carriers Northwest, American and US Air. The commuter carriers which use South Terminal are Empire Airlines and Digital (private, company aircraft) at Gate 1, and Air Hyannis, Commuter Airlines, Command Airways, Cosmopolitan Commuter Airline, Pilgrim Airlines and Will's Air at Gate 29. The terminal and airline facilities are all adequate for 1980 passenger and traffic volumes. Circulation at the terminal works well except for excessive speeds on the terminal roadway, which are encouraged by the long circulation loop. No changes in the system layout are under discussion. It is not currently possible to go from Southwest Terminal to the upper level of South Terminal. Changes in Southwest Terminal circulation which would allow this movement to occur are presently under consideration by Massport.

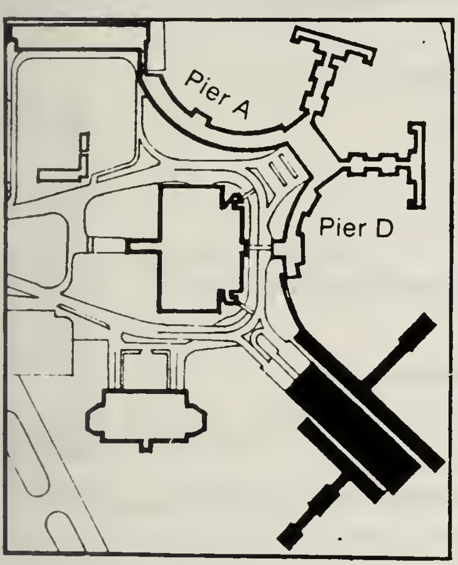


Figure 6.13
South Terminal Location

The facilities of the three airlines are adequate. American Airlines ticket counter is approaching its threshold and Northwest's baggage claim and US Air's ticket counter have relatively little excess capacity; however it is possible to enlarge these facilities with only minor internal renovations.

The terminal expansion options are simple extensions of the existing terminal to increase parking and curb space and increase the number of gates. Option 2 also extends the terminal along Pier D and has a ramp connecting Pier D to the Central Garage; this would enhance the accessibility of that terminal area.

Figure 6.14

South Terminal Facility Thresholds

▬ Adequate Service

▥ Service Threshold

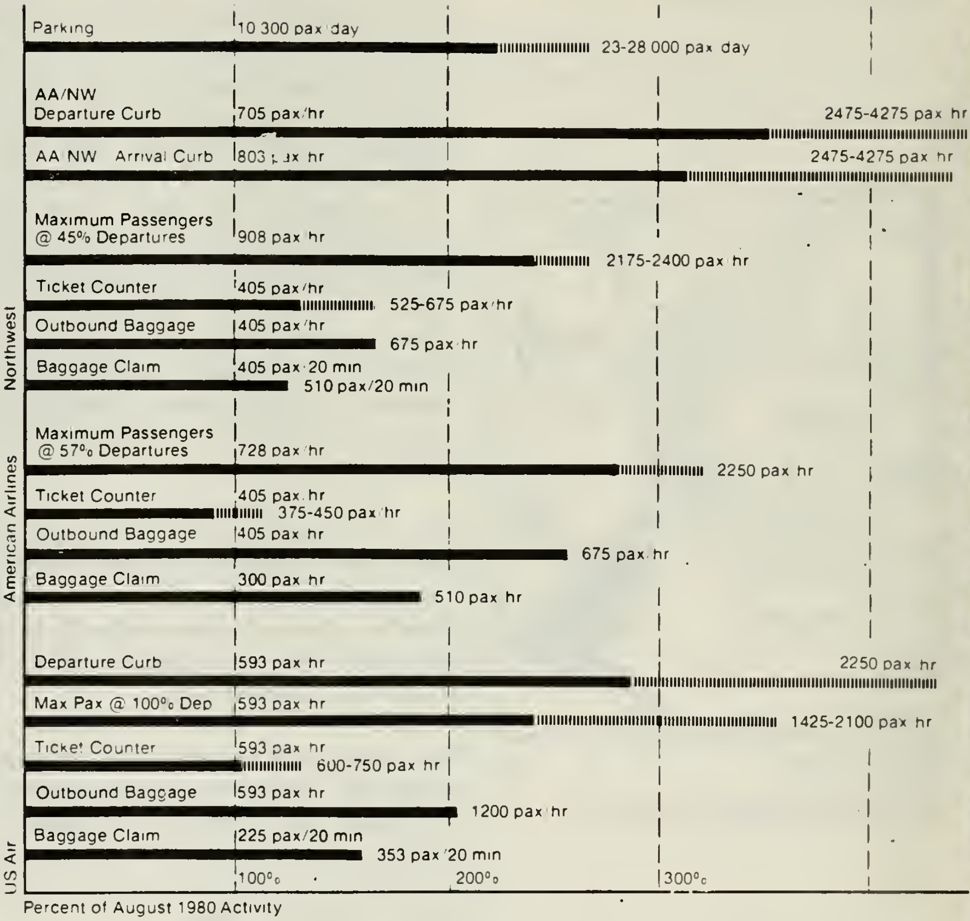


Table 6.3 Option Evaluation Summary, South Terminal

Terminal Option	% of Program Provided			Circulation Characteristics	Takings	Staging	Estimated Cost
	Gates	Curb	Adjacent Parking				
Option 1	200%	100%	110%	Direct connections for all movements	Airport Fire Station, some apron abutting terminal	Minor problems	$30 m
Option 2	225%	130%	125%	Most movements are direct, Pier D users must enter via S. Terminal, exit via N. Terminal	Airport Fire Station, some apron abutting terminal	Minor problems	$53 m

Figure 6.15

South Terminal Functional Areas and Passenger Circulation

▒ Curb

░ Ticket

▥ Departure Lounge

▦ Baggage Sort

▩ Baggage Claim

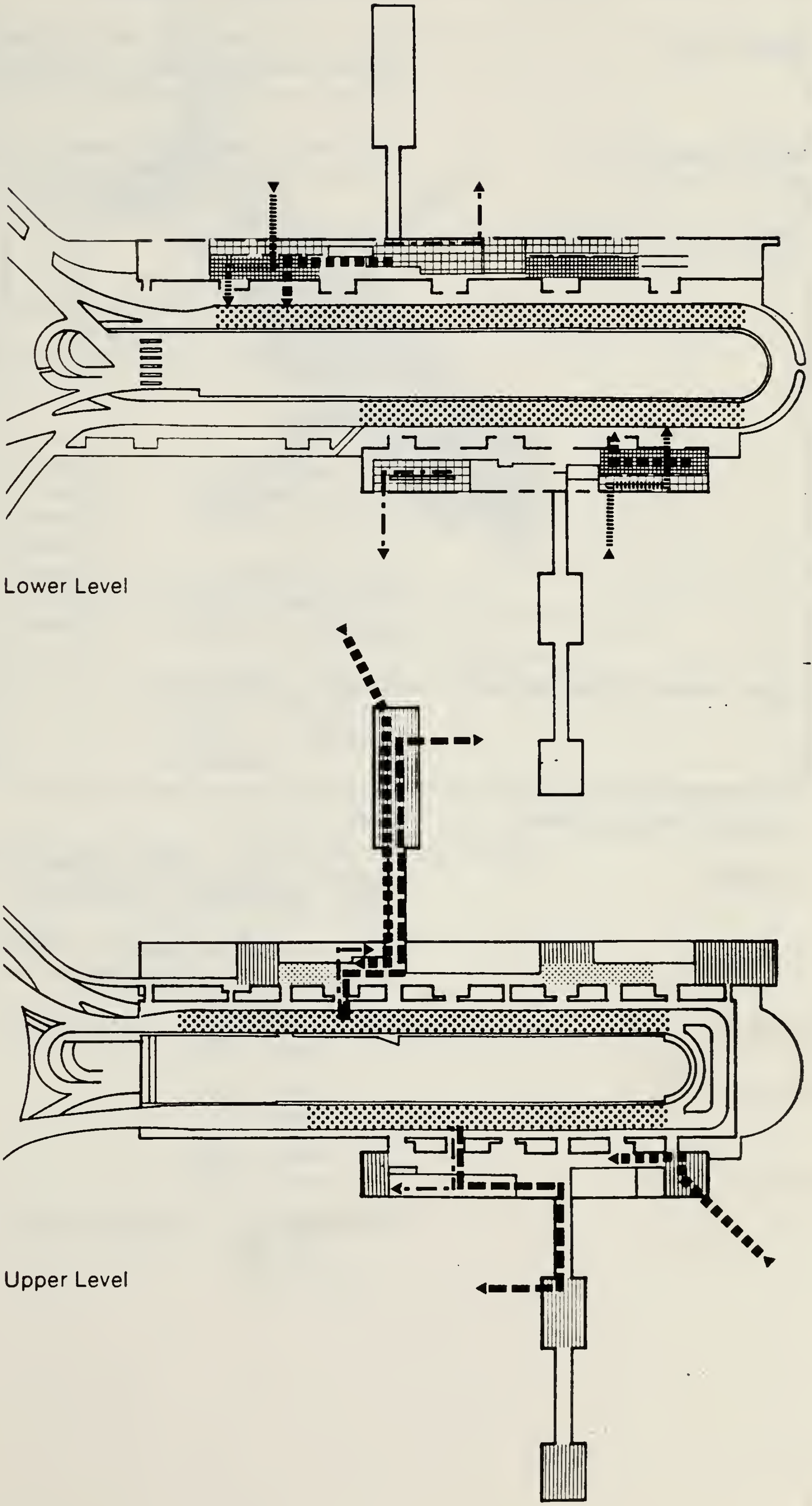
▬ ▬ ▬ Departures

· · — · Outbound Baggage

■■■■■■ Arrivals

┉┉┉ Inbound Baggage

0 100 200 feet 400



SOUTH TERMINAL: OPTION 1

DESCRIPTION

This option extends South Terminal and Garage thereby adding terminal area, gates and parking. The extension is to the south of the existing terminal.

RELATIONSHIP TO DESIGN PROGRAM

The design meets the program with curb and parking at the levels required and ample gate capacity.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby: Direct
Parking to Lobby: Direct, no parking space further than 300' from lobby.
Lobby to Gate: Direct, greatest distance 600'

Vehicular

Entrance to Curb: Direct
Curb to Parking: Direct
Parking to Curb: Direct at lower level, cannot return to upper level from parking.
Curb to Exit: Direct
Entrance to Parking: Direct
Parking to Exit: Direct

COST (ORDER OF MAGNITUDE)

Garage	$13.0 M
Terminal	12.0 M
Roadway	4.9 M
	$29.9 M

STAGING IMPLICATIONS

None

TAKINGS

Airside takings for entire extension, the Fire Station is taken and must be relocated.

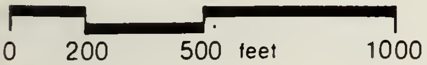
COMMENTS

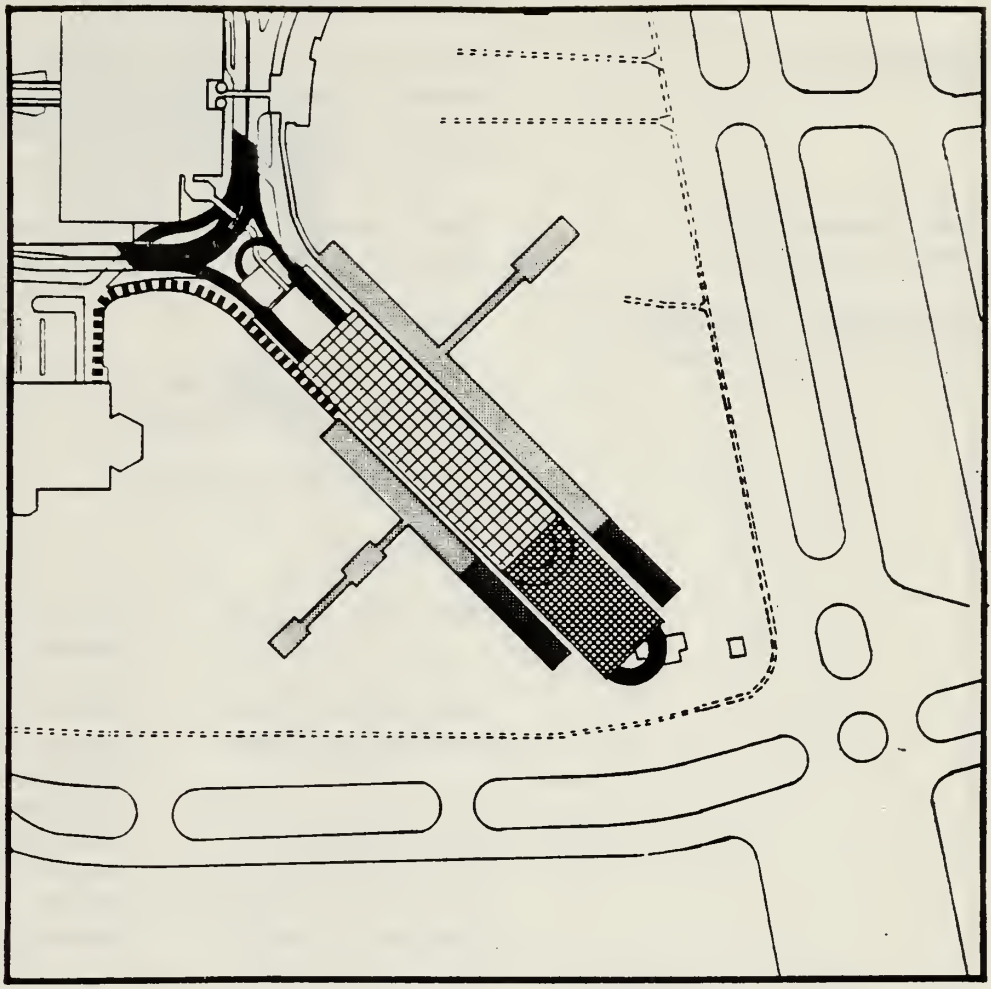
This extension could be constructed easily - it is needed for curb and parking capacity but not for gate capacity.

Figure 6.16

South Terminal
Option 1

- ░ Existing Terminal
- ■ New Terminal
- ▨ Restructured Terminal
- ▦ Existing Parking
- ▩ New Parking
- ■ Roadway
- ░ Landscape
- ▮▮▮▮▮▮▮▮ Pedestrian Connection





New Floor Area: 116,000 SF on two levels

Restructured Floor Area: None

Gates:
23 Existing
3 New
26 Total

Curb Length:

1650'	Upper	Existing
1650'	Lower	
700'	Upper	New
700'	Lower	
2350'	Upper	Total
2350'	Lower	

Parking Spaces:
2695 Existing
1100 New
3795 Total

SOUTH TERMINAL: OPTION 2

DESCRIPTION

This option extends South Terminal to the south as in Option 1 and also extends on to Pier D and puts a short wing toward Southwest Terminal. Pier D is connected to the Central Garage by a third level garage structure.

RELATIONSHIP TO DESIGN PROGRAM

This option provides ample curb and parking area and an ample number of gates.

FUNCTIONAL & SERVICE QUALITY EVALUATION

__Pedestrian__

Curb to Lobby:	Direct
Parking to Lobby:	Direct
Lobby to Gate:	Direct

__Vehicular__

Entrance to Curb:	Direct; users of Pier D must go around South Terminal to get to the curb.
Curb to Parking:	Direct
Parking to Curb:	Direct at lower level South Terminal and at Pier D; cannot go from parking to upper level at South Terminal.
Curb to Exit:	Direct; Pier D users must go through North Terminal to exit.
Entrance to Parking:	Direct
Parking to Exit:	Direct

COST (ORDER OF MAGNITUDE)

Terminal	$23.0 M
Garage	13.2 M
Roadway	8.7 M
Ramp	1.0 M
	$45.9 M

STAGING IMPLICATIONS

Construction of New Pier D and the garage linking it to the Central Garage would require relocating the Airlines now using Pier D. Special construction techniques needed for garage over main road.

TAKINGS

Airside takings as in Option 1.

COMMENTS

The extension of South Terminal would be easily constructed. The short extension towards Southwest Terminal would link up with the new Southwest Terminal shown as Southwest Option 4. The Pier D extension would complete the link with North Terminal as shown in North Option 2.

Figure 6.17

South Terminal Option 2

▭ Existing Terminal

■ New Terminal

▨ Restructured Terminal

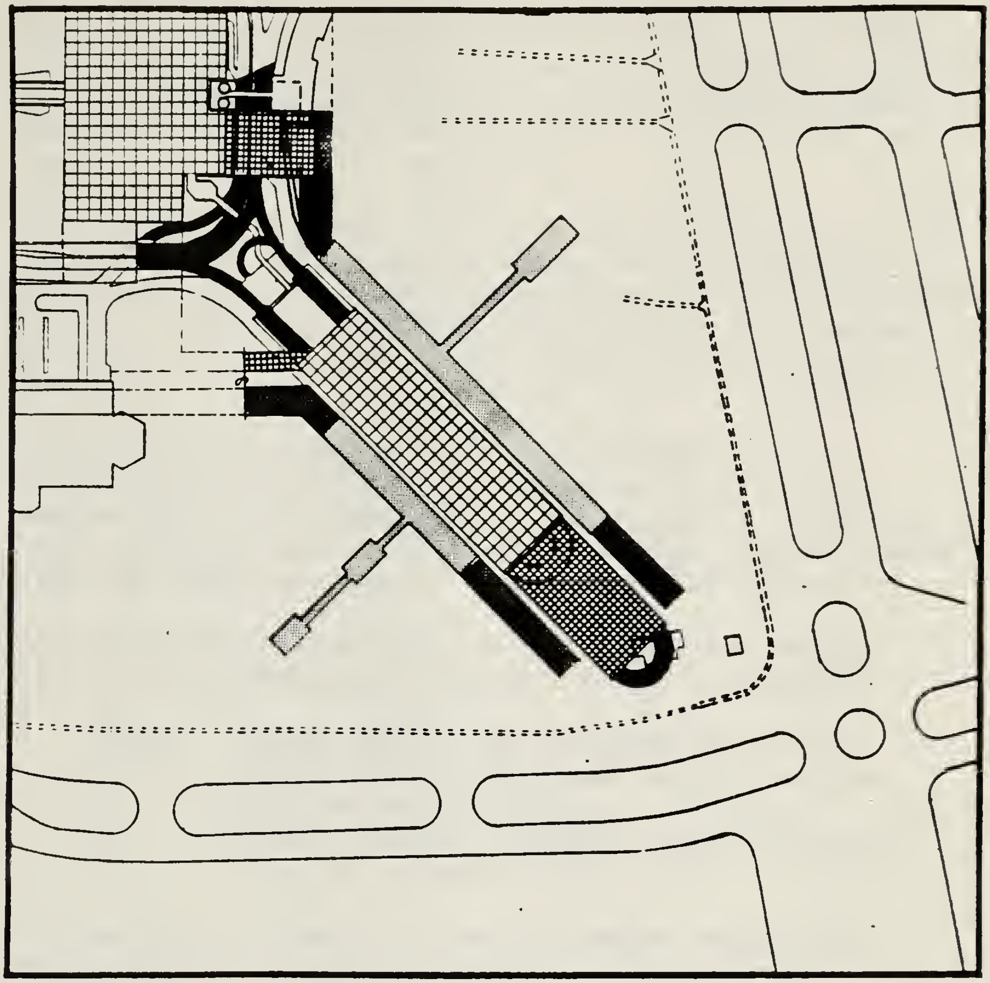
▦ Existing Parking

▩ New Parking

■ Roadway

░ Landscape

▮▮▮▮▮▮▮▮ Pedestrian Connection



New Floor Area: 228,000 SF on two levels

Restructured Floor Area: None

Gates:
23 Existing
3 New
26 Total

Curb Length:		
1650' Upper	1650' Lower	Existing
1390' Upper	1390' Lower	New
3040' Upper	3040' Lower	Total

Parking Spaces:
2695 Existing
1610 New
4305 Total

North Terminal

North Terminal has the greatest passenger volume at Logan and is the home for the certificated carriers Delta, TWA, United, Piedmont and Republic. Gate 24 is vacant. Pier A houses the certificated carriers Air Canada and Air New England. The commuter lines Princeton Aviation Corp. and Commuter Airlines, Inc. use Gate 8.

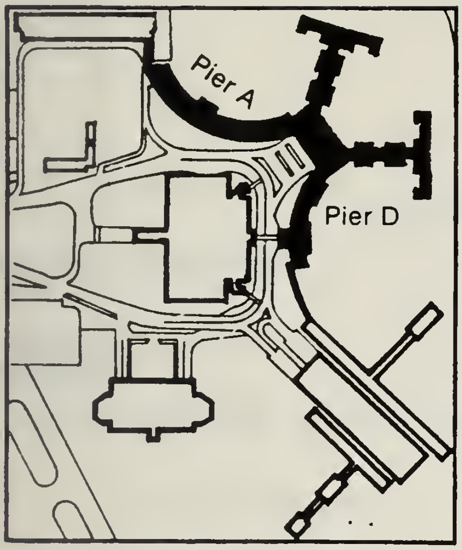


Figure 6.18
North Terminal Location

North Terminal has only 37 metered parking spaces near the building. The Central Garage serves as the terminal's parking area. Much of the design effort for North Terminal has been focused on improving access between the curb and parking, partly in order to help reduce illegal parking at the curb.

The threshold analysis revealed that a number of the terminal-wide and airline facilities are at, or approaching, their thresholds. Both departure and arrival level curbs are near their limit, even with shortened dwell times the departure (upper) curb is near saturation.

For the three major carriers United, Delta and TWA the following thresholds are being approached or exceeded:

United	Ticket Counter and Outbound Baggage Area
Delta	Ticket Counter, Outbound Baggage Handling Area and Baggage Claim.
TWA	Ticket Counter, Outbound Baggage Handling Area and Baggage Claim.

The number of thresholds being approached suggests that minor modifications of the terminal will not long accommodate all the facilities which are needed. Therefore, any medium to long range options for the terminal need to include an expansion of the total floor space of the terminal.

The major design goals addressed in the terminal options are:

- To make vehicular connection from the terminal curb to parking, and parking to curb;
- To increase the terminal's curb space;
- To keep the curb as close as possible to the gates;
- To increase the floor area of the terminal lobby.

Massport is currently working with the North Terminal airlines to plan for expansion of curb and lobby facilities. One problem which has emerged in discussions with the users is that, while curb congestion is a serious problem for all users, it is not in the self-interest of any individual airline to move its ticketing area further from the central lobby where it can be served by extended curb; to do so would inconvenience that airline's passengers by making their walk to the gates longer, while benefitting the competing airlines with reduced curb congestion. This is a common institutional planning problem which Massport must eventually solve through bargaining.

Figure 6.19

North Terminal Facility Thresholds

▬ Adequate Service

▥ Service Threshold

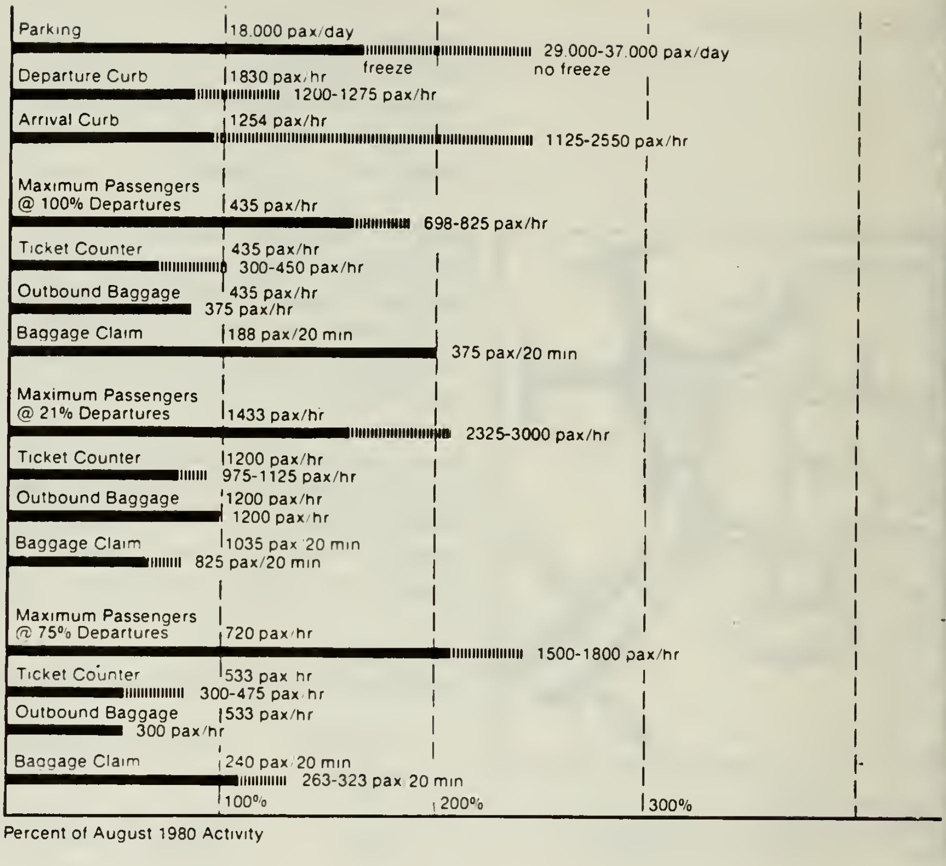


Table 6.4 Option Evaluation Summary, North Terminal

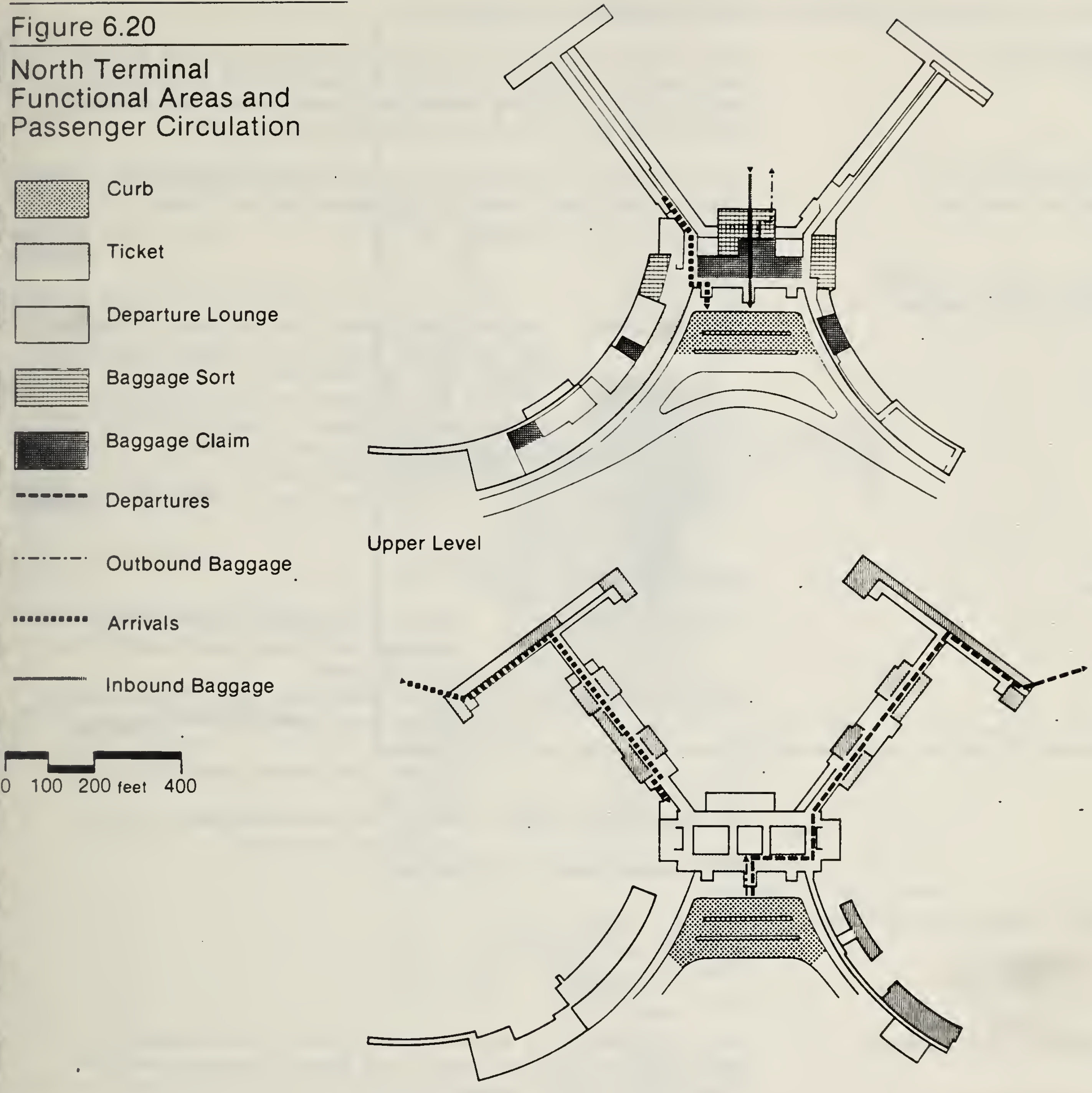
Terminal Option	% of Program Provided			Circulation Characteristics	Takings	Staging	Estimated Cost
	Gates	Curb	Adjacent Parking				
Option 1	125%	70%	none[a]	Problems with curb capacity; circulation unclear and circuitous; long walking distances	Minor airside at Pier A	Minor disruption of terminal operations	$13 m.
Option 2	125%.	100%	30%[b] at Piers A and D	Fairly direct; circulation still somewhat complicated	Minor airside at Piers A and D	Moderate disruption of terminal and main roadway	$51 m.
Option 3	105%	155%	60%[b] within the new terminal	Direct connections for all movements	Remove existing terminal and apron, new configuration	Major problems; relocation of N. Terminal users during construction	$140 m.

[a] Parking at Central Garage.

[b] Direct vehicular connection provided to and from Central Garage.

Figure 6.20

North Terminal Functional Areas and Passenger Circulation



Upper Level

Lower Level

NORTH TERMINAL: OPTION 1

DESCRIPTION

This option rebuilds the portions of Piers A and D which are closest to North Terminal and adds curb in front of both Piers, providing additional curb, lobby and baggage facilities for the existing North Terminal gates.

RELATIONSHIP TO DESIGN PROGRAM

Loss of gate not significant for domestic operations. Curb adequate at upper level if no buses operate there; at lower level curb is inadequate by 750'.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	50% of curb space is at islands; overpass may be needed for safety. All of curb is within 150' of building.
Parking to Lobby:	Parking is provided in Central Garage; pedestrian overpass connects to lobby. Typical distances 500' to 1000'. Illegal parking at curb is likely.
Lobby to Gate:	100' to 1200' from Pier A lobby to furthest gate.

Vehicular

Entrance to Curb:	Direct connection. Short stacking distance may cause back-ups on main roadway loop.
Curb to Parking:	Very circuitous: exit from Central Garage and reverse direction at Hilton.
Curb to Exit:	Direct, but U-turn required from Pier A.
Entrance to Parking:	Direct if one understands need to use Central Garage.
Parking to Exit:	Direct

COST (ORDER OF MAGNITUDE)

Pier A	$ 5.6 M
Roadway	5.4 M
Pier D	1.6 M
	$12.6 M

STAGING IMPLICATIONS

Some disruption of Piers A and D during construction, and at-grade link between North and Volpe terminals will be disrupted. Use of gates at Pier A must be coordinated with east wing of Volpe Option 1.

TAKINGS

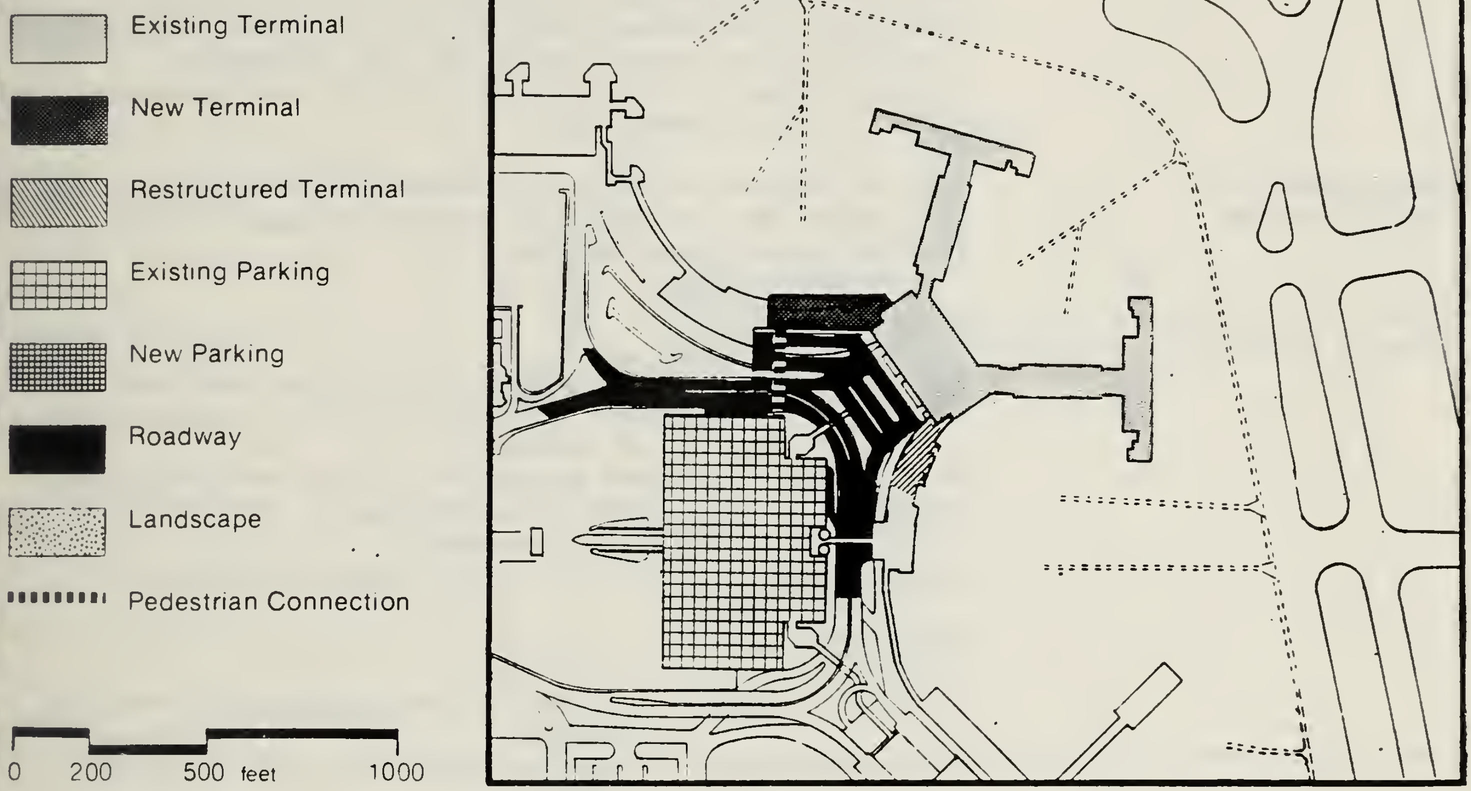
Airside encroachment at Pier A.

COMMENTS

Pier A extension beyond the extent of this option is possible as a later stage but has diminishing utility as curb and loggy space for North Terminal gates owing to long walking distances. Pier A gates may be associated with Volpe Terminal space while Pier A lower level terminal space and landside half of upper level is associated with North Terminal operations.

Figure 6.21

North Terminal
Option 1



New Floor Area: 56,000 SF on 2 levels at Pier A
(28,000 SF per level)

Restructured Floor Area: 32,000 SF at Pier D
(16,000 SF per level)

Gates: Possibly lose one at Pier A
27-28 at Piers A-D Total

Curb Length:		
850' Upper 860' Lower	Existing
700' Upper 700' Lower	New
1550' Upper 1560' Lower	Total

Parking Spaces: At central garage

NORTH TERMINAL: OPTION 2

DESCRIPTION

This option rebuilds Piers A and D and extends the Central Garage over the roadways and over rebuilt Piers A and D. A ramp up to the garage is located at the west end of Pier A and a ramp from the garage down to the curb level is provided at the southern edge of Pier D. These two ramps allow full circulation between the curb and garage. Elevators from the garage will provide direct pedestrian access into the terminals.

RELATIONSHIP TO DESIGN PROGRAM

Loss of gate not significant to domestic operations. Curb requirement met at grade and exceeded at upper level, allowing second level bus use.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	50% curb space is at islands; overpass may be needed for safety, all of curb is within 150' of building.
Parking to Lobby:	Improved connection between new garages and Piers A and D; distances to North Terminal lobby 500' or more.
Lobby to Gate:	Up to 1500' from west end of Pier A.

Vehicular

Entrance to Curb:	Direct; potential back-ups from Pier D curb.
Curb to Parking:	Fairly direct, via ramp at end of Pier A.
Parking to Curb:	Fairly direct, using ramp at end of Pier D.
Curb to Exit:	Pier D and North Terminal straightforward; Pier A traffic must reverse direction and make U-turn without second level connection through Volpe.
Entrance to Parking:	Either directly into Central Garage or via Pier A curb area.
Parking to Exit:	Either directly from Central Garage or via Pier D curb area.

COST (ORDER OF MAGNITUDE)

Garage	$15.0 M
Pier A	9.6 M
Roadway	8.9 M
Ramp	1.0 M
	$41.4 M

STAGING IMPLICATIONS

Rebuilding of Piers A and D and major construction over the main loop road for the garages. Temporary relocation of Pier D occupants required.

TAKINGS

Some airside encroachment at Pier A and to a lesser extent at Pier D. Present Pier A users relocated. Old tower building not affected.

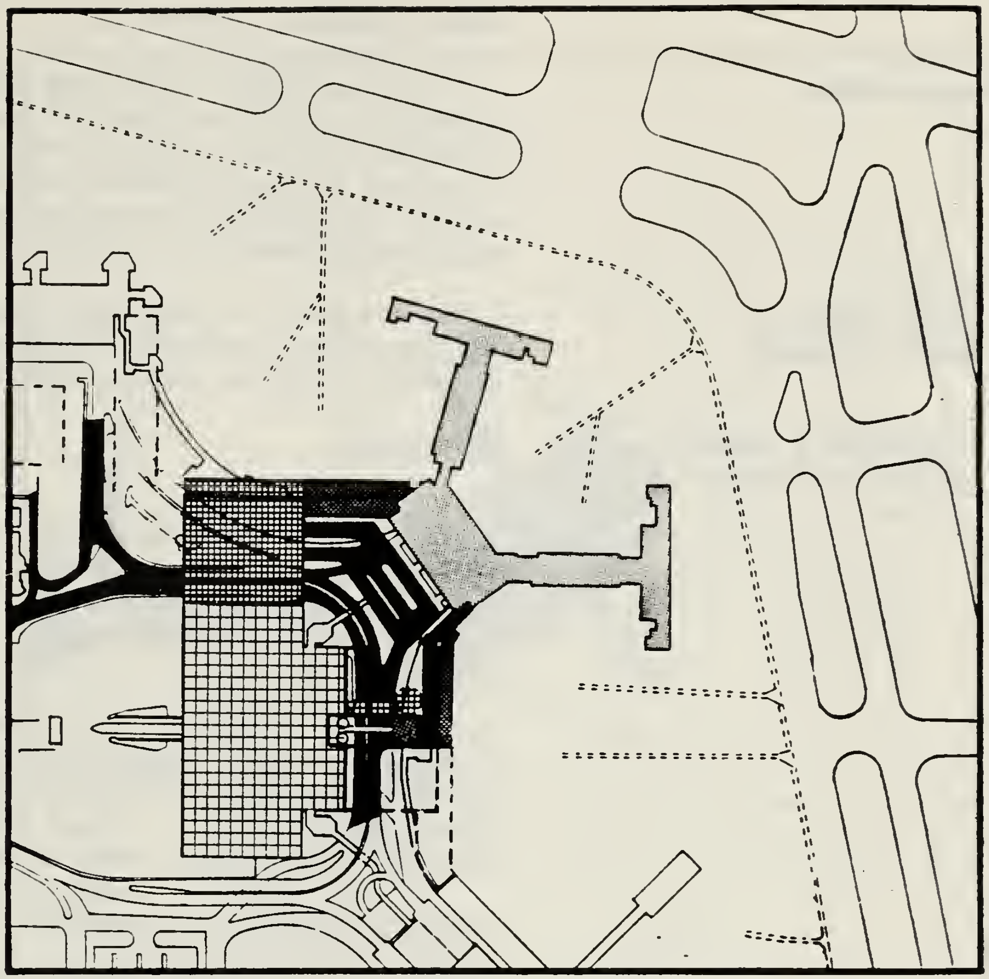
COMMENTS

See Option 1.

Figure 6.22

North Terminal Option 2

░	Existing Terminal
■	New Terminal
▨	Restructured Terminal
▦	Existing Parking
▩	New Parking
■	Roadway
░	Landscape
▮▮▮▮▮▮▮▮▮	Pedestrian Connection



New Floor Area: 96,000 SF Pier A
48,000 SF Pier D

Restructured Floor Area: None

Gates: Possibly lose one at Pier A
27-28 at Piers A-D Total

Curb Length:		
850' Upper 860' Lower	Existing
1300' Upper 1300' Lower	New
2150' Upper 2160' Lower	Total

Parking Spaces: 1850 on third through fifth level

NORTH TERMINAL: OPTION 3

DESCRIPTION

This option would include the complete rebuilding of North Terminal, Pier A and Pier D. The new terminal would be built on the same model as the existing South terminal with a central garage and long, linear terminal areas. The central garage would be extended out over Piers A and D with direct pedestrian access into the terminals.

RELATIONSHIP TO DESIGN PROGRAM

Gates adequate for program. Curb more than adequate. Parking in new garage not adequate, making connections over roadway to Central Garage important.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	Direct
Parking to Lobby:	Less than 250' for new garage; much longer walks for overflow parking.
Lobby to Gate:	100' to 800'

Vehicular

Entrance to Curb:	Direct connection
Curb to Parking:	Fairly direct to either garage
Parking to Curb:	Fairly direct from either garage
Curb to Exit:	Direct connection
Entrance to Parking:	Good either to Central Garage or North Terminal Garage
Parking to Exit:	Direct

COST (ORDER OF MAGNITUDE)

Terminal	$ 60.0 M	(excludes relocation costs)
Garage	44.2 M	
Roadway	33.0 M	
Ramp	1.0 M	
	$138.2 M	

STAGING IMPLICATIONS

Major problems. Rebuilding all of North Terminal and Piers A and D would require major relocation, also disruption of loop road during construction of modular garages at Piers A and D.

TAKINGS

Existing North Terminal and Piers A and D. Old Tower building not affected.

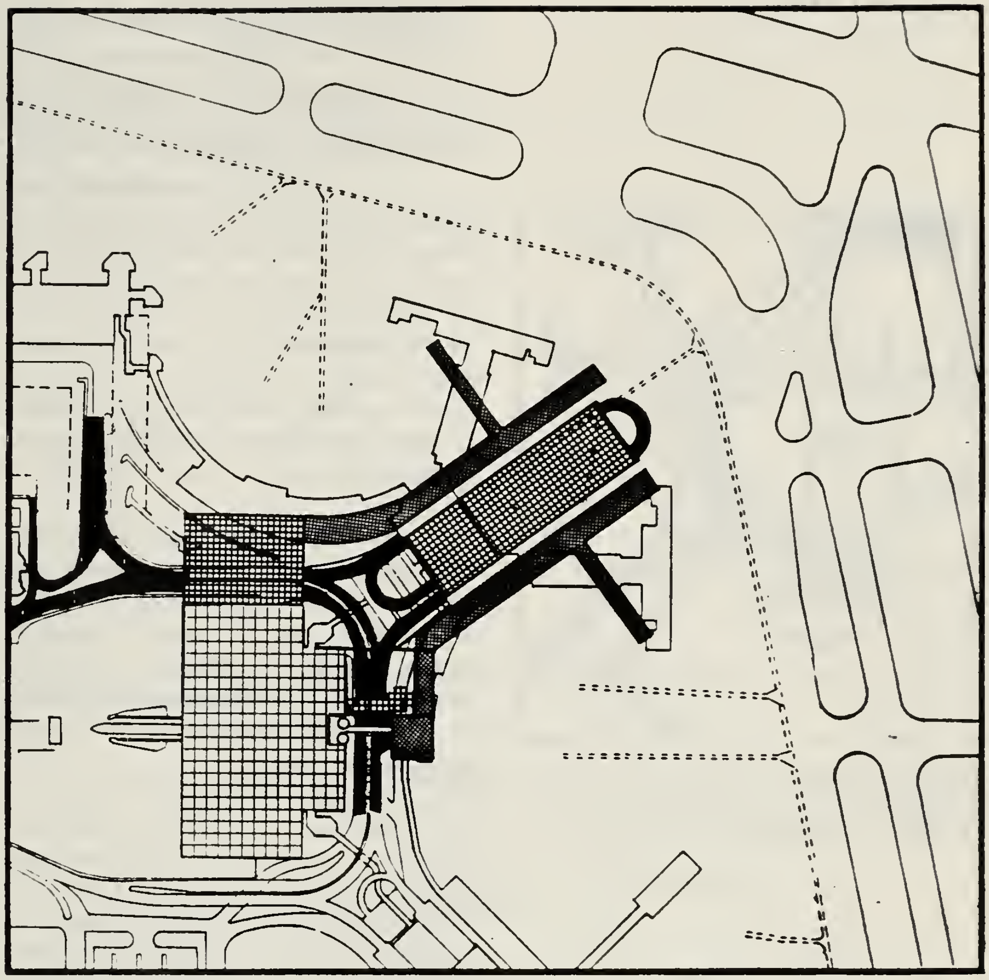
COMMENTS

It is doubtful whether the disruption and cost of this option and the special hardships imposed on the affected airlines are outweighed by improvements in quality of service over Option 2.

Figure 6.23

North Terminal
Option 3

- ▢ Existing Terminal
- ▓ New Terminal
- ▨ Restructured Terminal
- ▦ Existing Parking
- ▩ New Parking
- ■ Roadway
- ░ Landscape
- ▮▮▮▮▮▮▮▮ Pedestrian Connection



New Floor Area: 400,000 SF on two levels

Restructured Floor Area: None

Gates: Lose 4
23-24 Total

Curb Length: 3400' on each level
6800' Total

Parking Spaces: 3700

Volpe Terminal

Volpe Terminal primarily serves international air traffic, but Braniff Airlines and New York Air operate domestic flights from the terminal. All international arrivals requiring customs clearance come to Volpe while some international departures (those of TWA and Northwest) leave from other terminals.

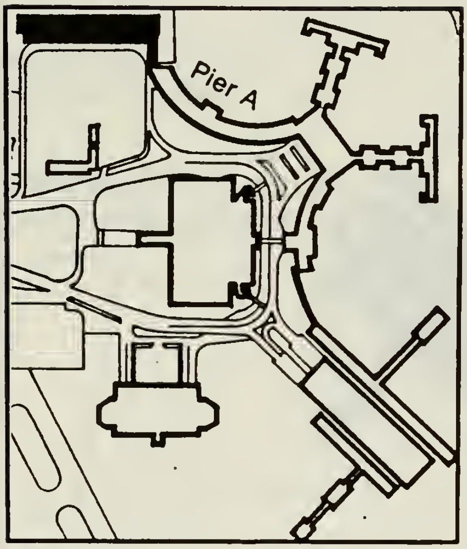


Figure 6.24
Volpe Terminal Location

Volpe was built in 1974 and was underutilized for several years. Since the terminal's completion, international air traffic at Logan has grown by 50%. The threshold analysis of Volpe reveals that many of the terminal facilities are at or approaching their capacity on an average day in the peak month (August). Observation of the terminal and discussions with MPA personnel have confirmed the findings of the threshold analysis and added to the list of terminal components which may require expansion or modification.

Parking, and Customs/Immigration facilities are currently operating at roughly their capacity. The curb, as presently managed, is inadequate. Baggage claim and total available gate capacity are able to accommodate more passengers. However, aircraft laying over between afternoon arrivals and evening departures may soon have to be towed to temporary parking positions to free gates for active operations.

The terminal options which have been designed for Volpe are based on passenger projections indicating that Year 2000 traffic will be 260% of 1980 traffic. Most of Volpe's facilities will be seriously inadequate with passenger increases at a level only 30% higher than 1980. However, forecasts for international air traffic are especially unreliable. The market is separate from the domestic market, the available hours for convenient operations are fewer and the seasonal variations are great. Therefore, this part of Logan's traffic should be carefully watched for changes in volume or shifts in traffic.

In addition to the facilities mentioned above, Volpe's passenger check-in and baggage handling areas are often crowded. Each of the international airlines at Volpe has only a small amount of floor space which must handle a surge of 747 or DC10 passengers once a day. For counter space, the solution seems to lie in providing adequate queuing and waiting space so that although the lines are long, the conditions are not crowded. This question should be examined fully when schematic design of terminal improvements begins. Location of lease areas should attempt to put airlines with different departure hours next to one another.

Figure 6.25

Volpe Terminal Facility Thresholds

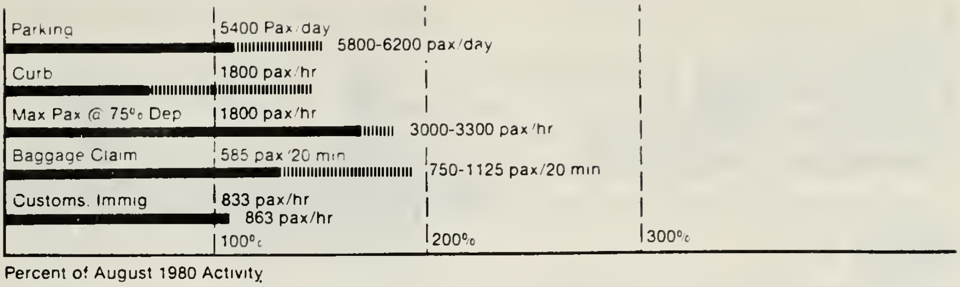


Table 6.5 Option Evaluation Summary, Volpe Terminal

Terminal Option	% of Program Provided			Circulation Characteristics	Takings	Staging	Estimated Cost
	Gates	Curb	Adjacent Parking				
Option 1	100%[a]	140%	90%	Direct connections for all movements	AA Cargo Building, eventually AA Hangar	Minor problems	$99 m.
Option 1a	100%[a]	90%	90%	Direct connections for all movements	AA Cargo Building, eventually AA Hangar	Minor problems	$75 m.
Option 2	100%[a]	150%	90%	Direct connections for all movements	AA Cargo and Hangar, possibly small part of TWA Apron	Minor problems	$102 m.
Option 3	100%[a]	125%	90%	Direct connections for all movements	AA Cargo and Hangar, corner of TWA apron	Minor problems	$99 m.

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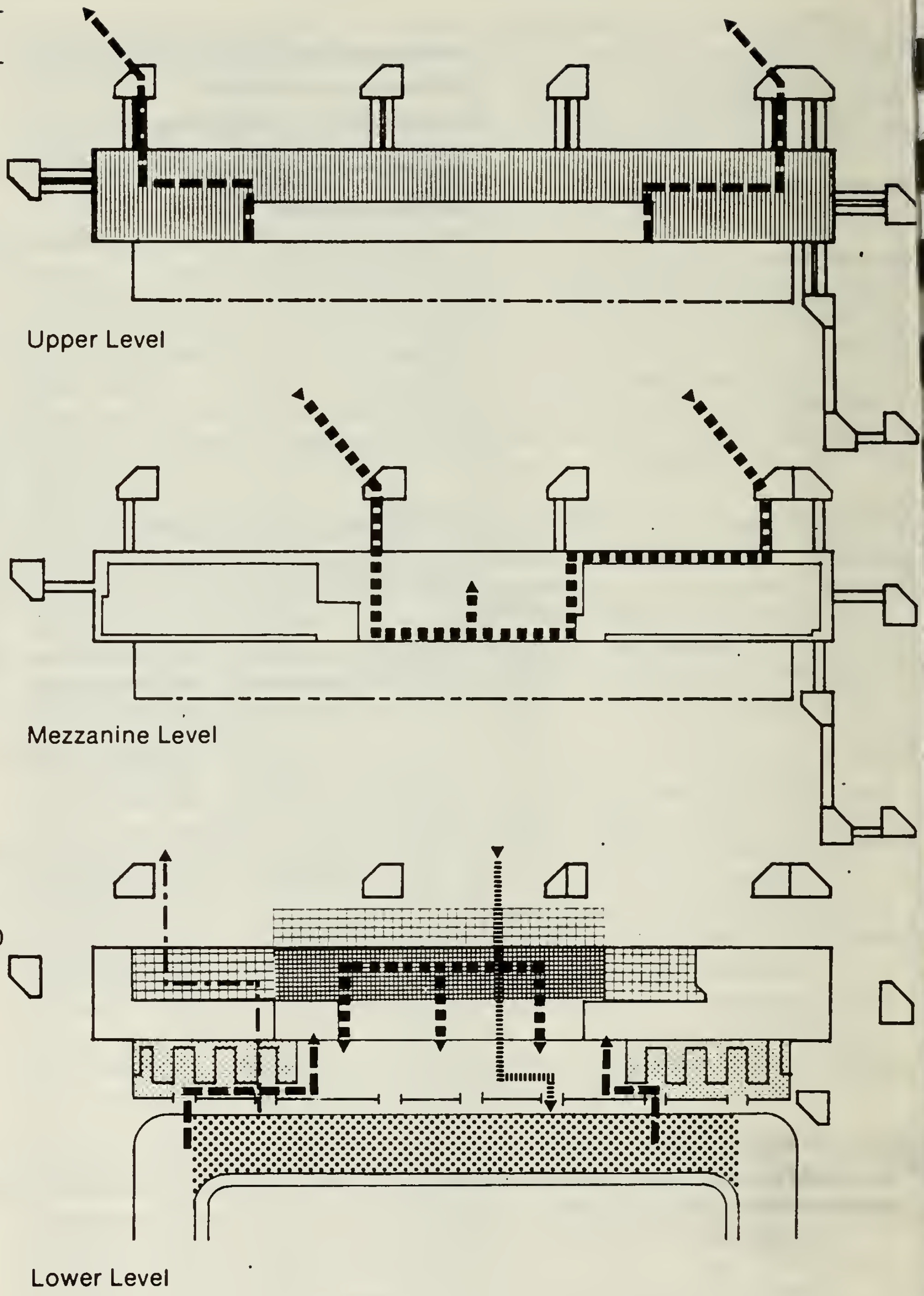
[a] No option provides gates for all planes projected to be laying over (i.e. inactive for more than one hour between arrival and departure).

Figure 6.26

Volpe Terminal Functional Areas and Passenger Circulation



VOLPE TERMINAL: OPTION 1

DESCRIPTION

Perpendicular wings added on each side of Volpe, creating U-shaped building. Circulation is on two levels, counter clockwise around a central garage serving all three wings of the terminal. Customs areas to be located in each new wing. East wing serves three gates in Pier A plus gates 1 and 2 at Volpe.

RELATIONSHIP TO DESIGN PROGRAM

Meets requirement for live gates plus half of layovers. Accommodates all private vehicles on either curb level and all parking demand. Floor area may be tight for customs.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	Can separate private auto from bus/limo/taxi by level. 70% of curb length is at islands, requiring pedestrian crossing or overpass. All curb within 100' of lobby.
Parking to Lobby:	Distance 175' to 400' via mezzanine level overpass
Lobby to Gate:	Most within 120', 6 others up to 600'

Vehicular

Entrance to Curb:	Via bypass road or main loop, which can be altered to provide direct lower level access.
Curb to Parking:	Direct connection, both levels
Parking to Curb:	Direct connection, both levels
Curb to Exit:	Second level via trumpet ramp, first level direct.
Entrance to Parking:	Via bypass road or main loop, which can be altered to provide direct lower level access
Parking to Exit:	Second level via trumpet ramp, first level direct.

COST (ORDER OF MAGNITUDE)

Terminal	$56 M	(excludes takings & demolition)
Roadway	26 M	(excludes bypass or main loop modification)
Garage	17 M	
	$99 M	

STAGING IMPLICATIONS

Minor problems in hook-up of elevated roadway and construction of garage and second level curb. Access must be coordinated with Pier A and main roadway improvements.

TAKINGS

American cargo building and eventually AA hangar.

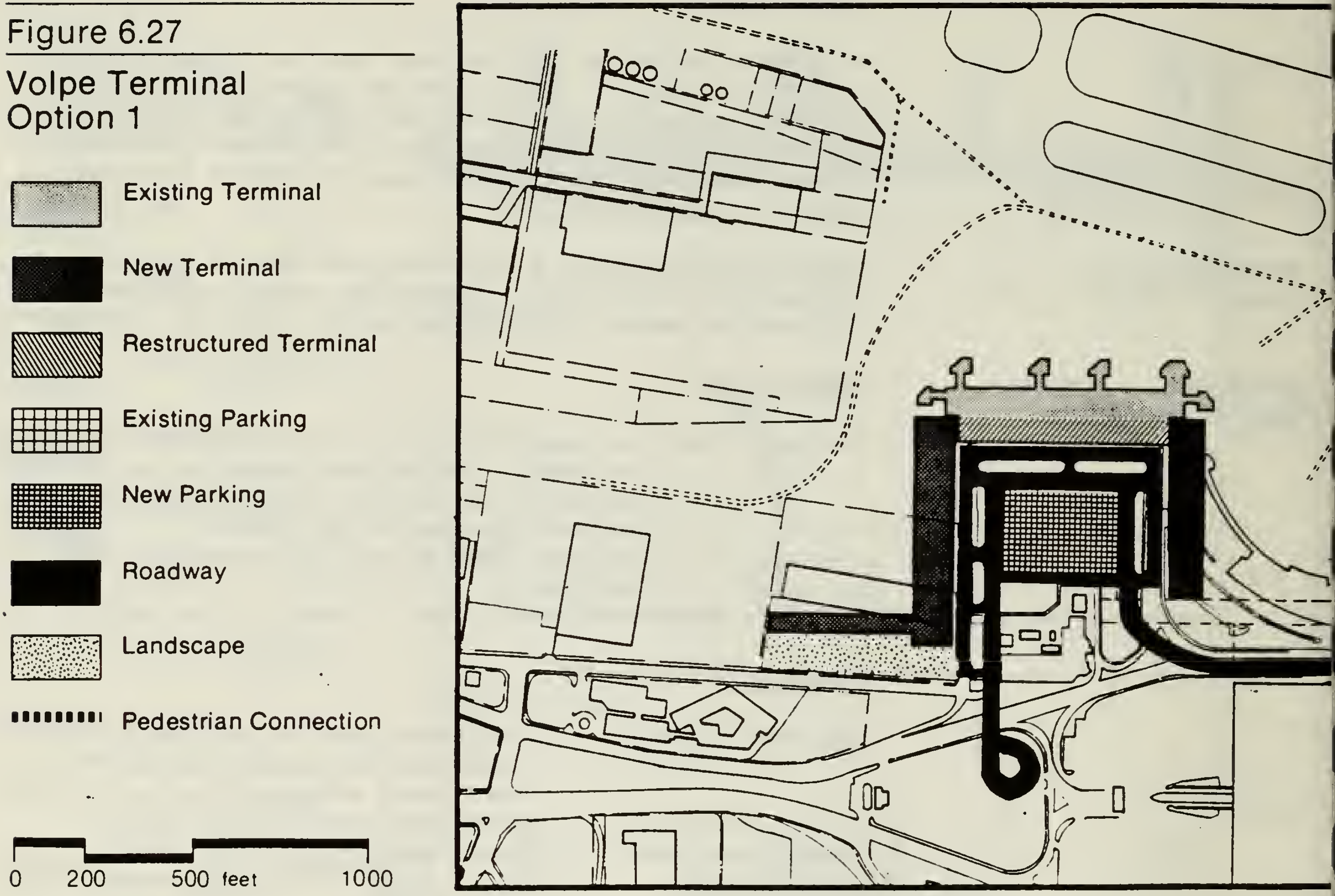
COMMENTS

Can use part of west wing as commuter or domestic terminal instead of international if international demand is less than programmed.

This location is environmentally less sensitive than south terminal for gate expansion.

Figure 6.27

Volpe Terminal Option 1



New Floor Area: 500,000 on 3 levels

Restructured Floor Area: 60,000 SF (Volpe lobby)

Gates: 6 New (4 via transporter or covered walkway)
18 Total (15 for 747's, 3 for DC-10's)

Curb Length: 4000' each level

Parking Spaces: 1400 (4-5 level garage)

VOLPE TERMINAL: OPTION 1a

DESCRIPTION	As in Option 1, but all terminal entrances are at grade.
NEW FLOOR AREA	500,000 SF total, on 3 levels
RESTRUCTURED FLOOR AREA	60,000 SF (Volpe lobby)
GATES	New: 6 (4 via transporter or long pier) Total: 18
CURB LENGTH	4000' at grade
PARKING SPACES	1400 (4-5 level garage)
RELATIONSHIP TO DESIGN PROGRAM	As in Option 1, but curb length is 93% of program target.
FUNCTIONAL & SERVICE QUALITY EVALUATION	*Pedestrian* Curb to Lobby: As in Option 1 Parking to Lobby: Walking distance 175' to 400' via overpass Lobby to Gate: See Option 1 *Vehicular* Entrance to Curb: Via main loop. Direct access from 2nd level roadway only. Curb to Parking: Direct connection Parking to Curb: Direct connection Curb to Exit: Direct Entrance to Parking: As for curb Parking to Exit: As for curb
COST (ORDER OF MAGNITUDE)	Terminal $56.0 M Garage 17.0 M Roadway 1.8 M $75 M
STAGING IMPLICATIONS	Minor problems in garage cnstruction, which displaces parking. Must be coordinated with Pier A improvements.
TAKINGS	As for Option 1
COMMENTS	See Option 1. This option is less desirable for domestic carriers whose arrivals and departures overlap; therefore it is less flexible than Option 1.

VOLPE TERMINAL: OPTION 2

DESCRIPTION

A new terminal is built parallel to outbound roadway with curb at both levels. Pedestrian connection is provided to Volpe, which is modified to expand lobby and to accept two level curb. This option can be modified to have at grade circulation only. Garages are built at Volpe and new terminal.

RELATIONSHIP TO DESIGN PROGRAM

Provides program target for live gates, but only one lay-over position. Can handle all private autos at either level. Programmed parking is provided. Customs space may be tight.

FUNCTIONAL & SERIVCE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	As in Option 1
Parking to Lobby:	Via mezzanine level overpass 100' to 300' walking distance
Lobby to Gate:	300' to 800' if garage is used.

Vehicular

Entrance to Curb:	Via bypass road or main loop which can be altered to allow direct lower level access. New terminal access is through Volpe loop.
Curb to Parking:	Direct connection, both levels
Parking to Curb:	Direct connection to lower level
Curb to Exit:	Direct for Volpe, using second level trumpet ramp. For new terminal traffic reverses direction; second level circulation ramps down to single egress roads.
Entrance to Parking:	As for curb.
Parking to Exit:	As for curb.

COST (ORDER OF MAGNITUDE)

Terminal	$ 56 M	(excludes takings & demolition)
Roadway	28 M	(excludes bypass or main loop modification)
Garage	18 M	
	$102 M	

STAGING IMPLICATIONS

As in Option 1.

TAKINGS

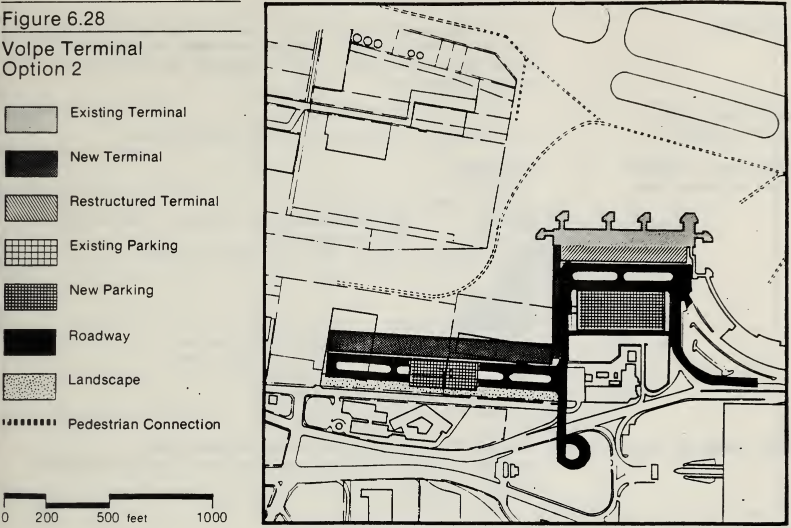
American cargo and hangar and possibly small portion of TWA apron.

COMMENTS

See Option 1. Option 2 is less desirable than Option 1 in need for additional garage with separate ramps and fee collection, and its poor connection to Volpe. A hybrid option with the east wing of Option 1 is also possible.

Figure 6.28

Volpe Terminal Option 2



New Floor Area: 500,000 SF on 3 levels Total

Restructed Floor Area: 60,000 SF (Volpe lobby)

Gates: 9 Existing
6 New, all with direct access
15 Total

Curb Length: 1800 per level at Volpe
2400 per level at new terminal
4200 per level Total

Parking Spaces: 850 at Volpe garage
550 at new terminal garage
1400 Total

VOLPE TERMINAL: OPTION 3

DESCRIPTION

A new wing is added diagonally from the west end of Volpe, with two level roadway. Garages are built in front of Volpe and the new wing. Can be modified to work with at grade roadway only.

RELATIONSHIP TO DESIGN PROGRAM

As in Option 1, except no layovers accommodated.

FUNCTIONAL & SERVICE QUALITY EVALUATION

Pedestrian

Curb to Lobby:	As in Option 1.
Parking to Lobby:	Via mezzanine level overpass, 100' to 300' walking distance.
Lobby to Gate:	150' to 800' if garage is used

Vehicular

Entrance to Curb:	As in Option 1
Curb to Parking:	Direct, both levels
Parking to Curb:	Direct to lower level
Curb to Exit:	See Option 2
Entrance to Parking:	As for curb
Parking to Exit:	As for curb

COST (ORDER OF MAGNITUDE)

Terminal	$56 M	(excludes taking & demolition)
Roadway	25 M	(excludes bypass or main loop modification)
Garage	18 M	
	$99 M	

STAGING IMPLICATIONS

See Option 1.

TAKINGS

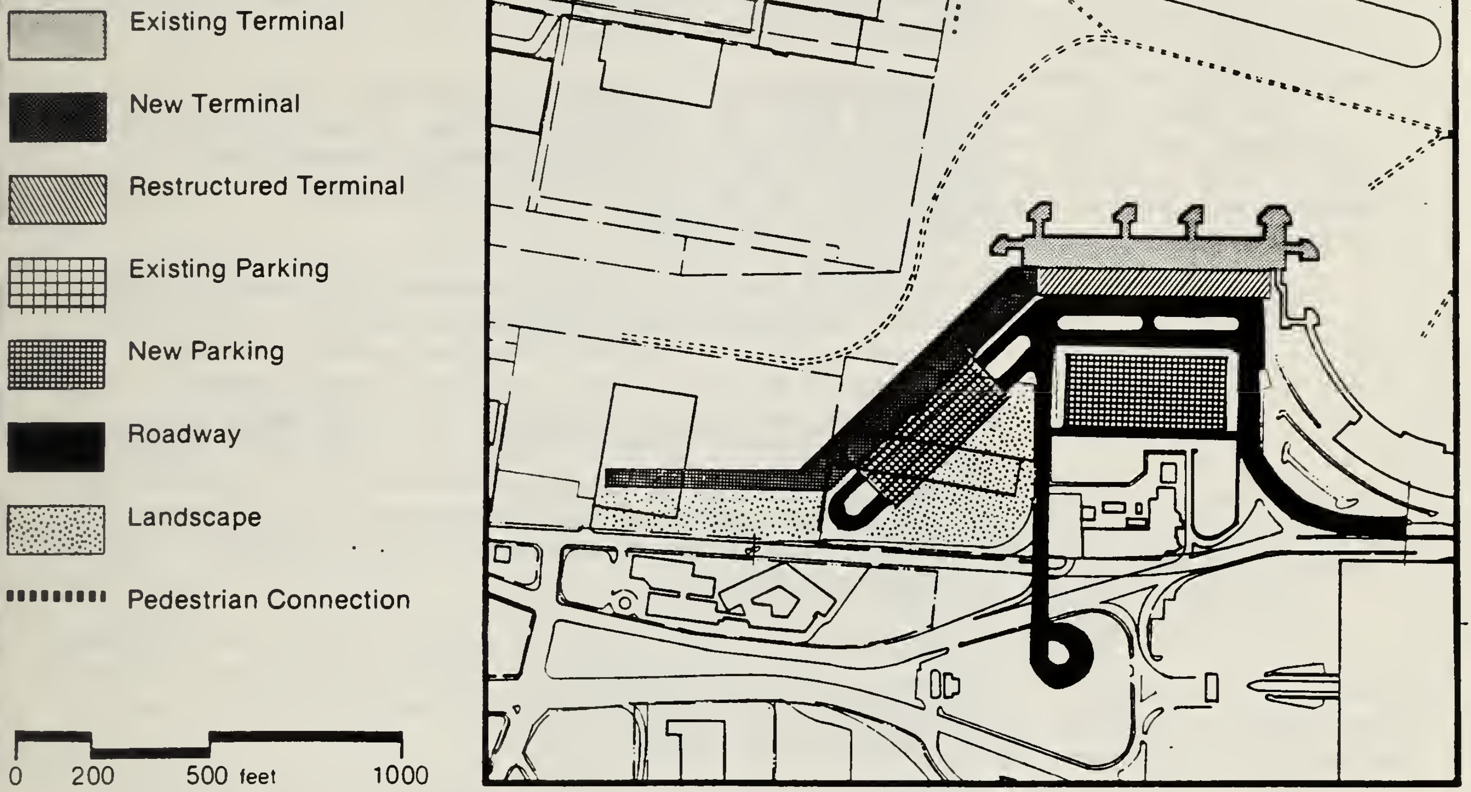
AA Cargo and Hangar, corner of TWA apron.

COMMENTS

This option is less desirable than others in providing one less aircraft position on the same parcels on North apron.

Figure 6.29

Volpe Terminal
Option 3



New Floor Area: 500,000 SF on two and three levels

Restructured Floor Area: 60,000 SF (Volpe lobby)

Gates: 9 Existing
5 New
14 Total

Curb Length: 4000' per level

Parking Spaces: 1400

Commuter Airlines

The Massport forecasts assume a peak hour number of 23 commuter operations by the year 2000. These operations will be in larger aircraft than are commonly used by commuters today, but minimum gate occupancy times should remain below 30 minutes and it should be possible to accommodate these operations in 13 to 16 gates depending on the extent of gate sharing.

A large proportion of commuter passengers make interline transfers with certificated airlines at Logan. This fact implies that commuter-related traffic volumes are relatively low and that good landside connections to other terminals are important.

Dispersal of commuter gates throughout the terminal zone provides reasonably good connections among carriers and utilizes gates and terminal areas too small for most certificated carriers. This is the present pattern at Logan. Its major disadvantage is the airside incompatibility of large jet aircraft with small propeller driven ones, especially when passengers must walk onto the apron to board planes. Close proximity of airlines with intensive interlining of passengers is an advantage, except perhaps to competitors.

An alternative to dispersal of commuter gates, and probably necessary to provide additional gates in any case, is the consolidation of commuter aircraft gates at one or two locations in the terminal zone.

The proposed Eastern Airlines Commuter Pier at Southwest Terminal has been studied and programmed by Massport. Depending on future fleet mix and growth in commuter operations, additional gates would probably be needed in the mid- to long-term. A second potential location for a commuter facility is the American Airlines hangar site on the North Apron; a commuter facility is shown here in Development Package Two (Figure 3.5).

A free-standing facility needs to be only one level, and 50 to 60 feet deep, with its length a function of available site dimensions and gates needed. A pier or covered walkway can be provided on airside.

If converted from maintenance to terminal use the American Airlines hangar site may be entirely used for international operations or may be split between this use and commuters. The site has adequate roadway and taxiway depth to accommodate a commuter apron, terminal, busway loop, and possibly a small amount of short-term automobile parking. It could be served by shuttle buses circulating on the entire terminal loop or connected by a mini-loop with the proposed Volpe Terminal extension, parking garage and elevated busway.

Chapter 7 Parking

Parking facilities at Logan must serve two user groups; passengers and employees. The location and price structure of parking for these two groups can be quite different. Usually, passenger parking is provided close to the terminals and is fairly expensive, discouraging employees from using parking spaces intended for passengers. Employee parking may be quite remote from the terminals or other employment areas. Vans or buses may be provided to bring employees to their work areas. While parking fees are lower than in passenger parking areas, efforts to encourage the use of public transportation have led to increasing charges for employee parking.

Passenger Parking

Airport Parking Concepts

Airport parking facilities can be better understood in terms of conceptual models. Most airport facilities can be related to one of the three models described below. Two of the models are based on specific locational concepts, the third is a hybrid of the first two.

Centralized Parking Model. In this model all the parking for the airport is located in one central location which serves two or more terminals. A people-mover system may be used to connect the parking area to each of the terminals. This type of centralized system is used at Tampa Airport. Drop-off and pick-up may be allowed at each terminal but there is no parking, either short or long-term except in the central garage. A modification of this model could have all parking located off-airport with all connections to terminals made via a public transport system.

Advantages:	Clarity of system; may reduce need for secondary roadways and reduce congestion on airport roads.
Disadvantages:	Inconvenient for those people wishing to park briefly; very dependent on efficient functioning of people-mover; inconvenient if no people-mover is provided.

Decentralized Parking Model. Each terminal is provided with enough adjacent parking to serve all its needs. The roadway system serving each terminal allows drop-off and pick-up of passengers and baggage at the terminal curb and parking without leaving the terminal. South Terminal at Logan is an example of this model.

Advantages:	Clarity of system; people can park very near the terminal; parking areas might

maintain a manageable scale and could be given individual identity.

Disadvantages: Inconvenient for people using different terminals for outbound and inbound flights; expensive to build; may be difficult to expand or modify; becomes extremely inconvenient and confusing if parking capacity is exceeded, as at Southwest Terminal.

Split Parking Model. This model is a hybrid of the first two and includes some centralized parking and some parking at each terminal. The parking may be divided into long-term at the centralized facility and short-term at the terminals. Circulation must be provided between each terminal, its adjacent parking area, and the central parking area. The desirability of the model depends on the directness of vehicular connections to and from the central parking. A people-mover may be desirable if there is a substantial distance between the central parking area and the terminal.

Advantages: Flexibility for airport planning; short-term parking convenient to terminals; short-term parking areas may be of a moderate scale and be given individual identity.

Disadvantages: May be confusing and inconvenient to users if pedestrian and vehicular connections to central parking are inadequate; people-mover may not be justified by share of passengers handled in central area.

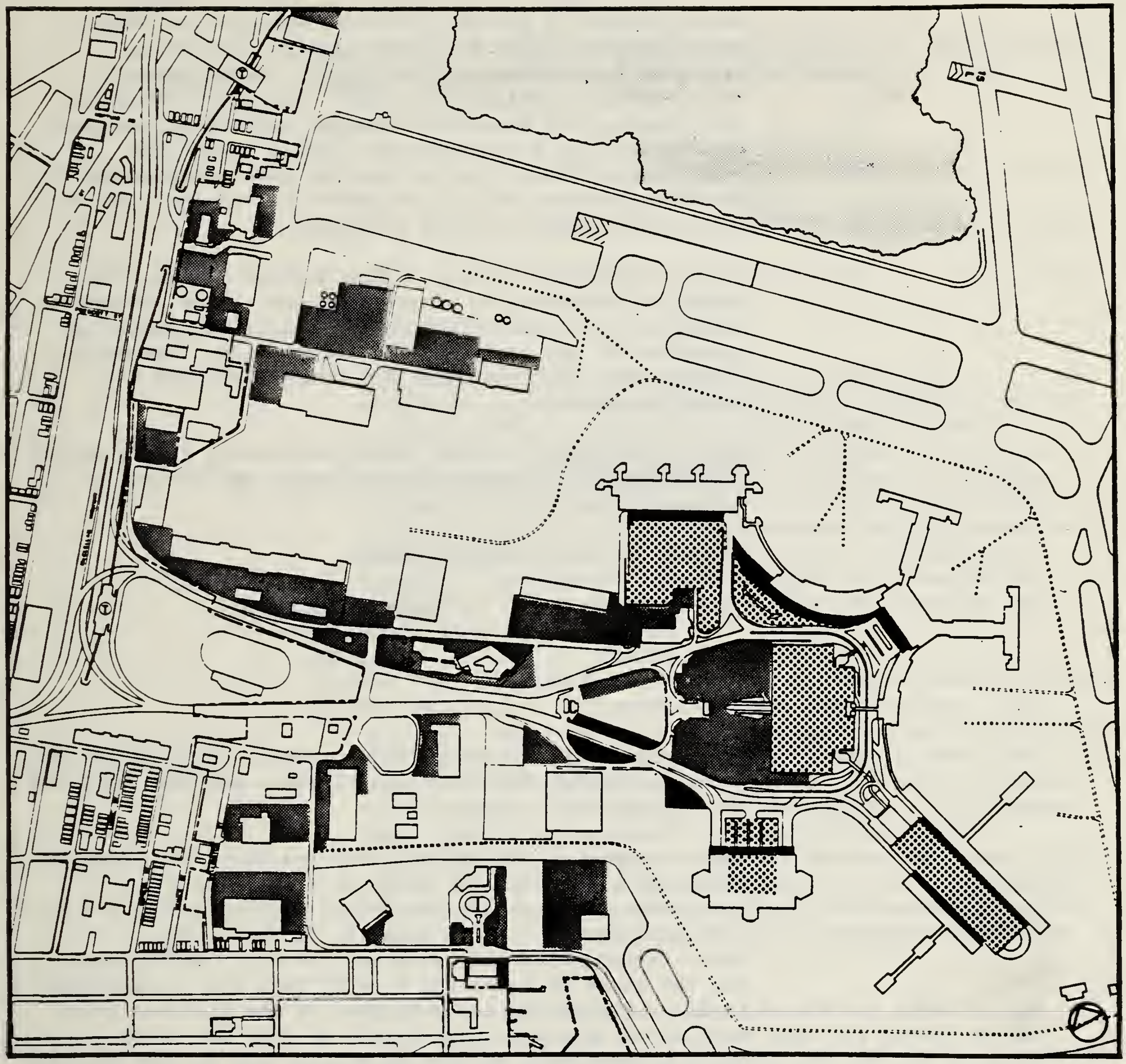
Existing Conditions

Location. The parking facilities for each terminal are located as follows:

Table 7.1 Existing Parking Facilities

Terminal	Short-term*	Long-term	Parking Over-flow
Southwest	at terminal	at terminal	frequent
South	at terminal	at terminal	rare
North	split	at Central Garage	rare
Volpe	at terminal	at terminal or at Central Garage	short-term overflows

*2 hours or less



Parking Area Locations **Figure 7.1**

■ Bus/Limousine and Taxi Layover

▩ Employee Parking and Truck Loading

▨ Public Parking

0 500 1000 feet 2000

South Terminal's parking fits the decentralized model. While North Terminal has split parking, the amount provided at that terminal is grossly inadequate and it approximates a centralized model. Southwest and Volpe were designed to have decentralized parking but are now or soon will be functioning on a split basis; the overflows to Central Garage include short-term parked vehicles because there is no effort to reserve sufficient short-term spaces at these terminals.

Because Logan's terminals follow several models, the system is confusing to airport patrons. Poor signage contributes to the confusion, but the inconsistency in operation is the real cause of the problem. The design options discussed later in this chapter address this issue of clarity.

Supply and Demand. Logan has approximately 10,370 public parking spaces at present. The spaces are divided as follows:

Table 7.2 Parking Spaces

Location	Number of Spaces*
Southwest	1156
South	2695
Central Garage	5411
Volpe	1108

*Includes presently frozen spaces, spaces which are currently allocated to employees, and both long and short-term spaces.

Most spaces are used as both long and short-term parking with only a few lots (in front of Pier A, SW and N Terminals) reserved for short-term parking by the use of parking meters. For the purposes of this study, short-term parking refers to any use of a parking space for two hours or less; any greater duration is long-term parking. Two hours has been used as the dividing point because it is a practical length of time for which parking meters can be used to monitor and collect parking fees; it is also a maximum time for most companions to remain at the terminal seeing off or meeting air passengers. For times greater than two hours a ticketing and attendent fee-collection system is more appropriate.

The breakdown between long and short-term parking demand for each terminal is shown below. This breakdown is based on the CSI passenger survey and parking garage analysis.

Table 7.3 Daily Parking Demand, April 1979

Terminal	Certificated Passengers	Parked Cars, Absolute Number and (per passenger) Long-Term	Short-Term*	Total
Southwest	10,194	760 (.07)	637 (.06)	1,403 (.14)
South	11,272	526 (.05)	1,028 (.09)	1,589 (.14)
North	15,274	1,107 (.07)	679 (.06)	1,786 (.12)
Volpe	3,111	152 (.05)	508 (.17)	670 (.22)

*Less than two hours

Capacity. Parking thresholds were estimated by establishing a relationship between the number of cars to be parked and the number of parking spaces needed. Combining this information with the figures on parking demand per passenger (Table 7.3) indicates the passenger volumes at which parking reaches its threshold. It is known that parking demand per passenger varies seasonally with the proportion of business travel, reaching peak levels in the winter; further monitoring is needed to refine the estimates given here which are based on the April 1979 survey.

For long-term parking, the number of spaces needed is based on the average length of time each space is used. This average is approximately 40 hours for cars parked more than two hours. Simulation of parking turnover, using the observed distribution of dwell times, indicates a need for slightly over 2 spaces for each car parked on an average day. Weekly and seasonal fluctuations may make it desirable to maintain a surplus of perhaps 15% above this number of spaces so that peak demand can be accommodated without overflow; however, the desirable amount of surplus space is partly a question of garage management policies that maximize revenue.

Short-term parking space requirements are based on the percentage of daily parked cars that are parked at one time. This is estimated to be 16-17% for the domestic terminals and 23% for Volpe.

Based on parking demand per passenger and the long-term and short-term factors just described, the following thresholds have been derived (Table 7.4). These thresholds do not include any surplus for weekly peaking, so overflows may begin to occur as daily passenger volumes approach the thresholds.

Forecasts of public parking space demand are shown in Table 7.5. These forecasts include a 15% surplus to handle peak loads but also assume ground transportation policies that will reduce auto use by 20% by the year 2000. The range

Table 7.4 Terminal Parking Thresholds

	August 1980 Avg. Daily Passengers[a]	Threshold Avg. Daily Passengers[a]	% of Aug. 1980
Southwest	8,600	7,500	87
South	10,300	23,000	224
North[b]	17,750	29,000 - 37,000	166 - 204
Volpe[c]	5,400	5,800	107
TOTAL	42,050	65,300 - 73,300	
SW & North	26,400	36,500 - 44,500	138 - 169

[a] Excludes commuter airlines and Air New England

[b] Range in threshold reflects continued or discontinued parking freeze

[c] Includes all Air Canada operations and parking lot at Pier A

Table 7.5 Parking Forecast for Year 2000

	Year 2000 Forecast		
Terminal	August Avg. Daily Passengers[a]	Parking Spaces	New Spaces Required[b]
Southwest	22,000	3,100	1,950
South	27,000	2,900	200
North	46,000	5,600	700
Volpe[c]	14,000	1,500 - 1,700	700 - 900
TOTAL	109,000	13,100 - 13,300	3550 - 3750

[a] Certificated passengers.

[b] Excludes present employee spaces.

[c] Range reflects possible variation in short-term parking.

given for Volpe is based on the amount of short-term peaking that occurs, either 23% as today or 17% if peak hours spread by the year 2000.

Management Policies

Parking questions at Logan Airport are in part a matter of understanding the management of the various parking facilities. One reason that the lack of interconnections between North Terminal and a reasonably sized parking area causes fewer problems than might be predicted is that illegal parking serves as a stop-gap for many people who need to park briefly. This practice greatly increases curb congestion.

A number of the options proposed for Logan's garages will require management techniques which are not currently used at the airport. The use of garages to supplement inadequate short-term parking space will require the division of parking garages into long and short-term parking areas. This can be accomplished through "double dipping" of parking tickets. Short-term areas would be reserved near the terminals and would require the restamping of the parking ticket to gain entry. The fare structure for double-stamped tickets would strongly discourage the use of the short-term area for long term parking. This technique has been used successfully elsewhere.

Massport currently discourages very long-term parking with its high daily parking rate, currently $6.00. If surplus parking spaces are created in the course of Massport's building program, the rate structure could be modified to attract additional parking of this kind. The provision of an adequate number of long-term spaces may actually reduce the number of vehicle trips to the airport because there is only one round trip made when a car is parked long-term, whereas two round trips are made if a traveller is dropped-off on departure and then picked-up on arrival.

Off-airport parking requires careful planning by Massport and private operators of the lots. Of key importance is the siting of the lots to avoid community impacts. The roadway capacity near the lots must be checked to insure that they will not cause congestion of local streets. Finally, Massport policy may wish to discourage the expansion of private lots because they compete with the Authority's own revenue generation capacity.

Options for Expansion

The options for expansion of the parking garages at Logan are closely linked to terminal options. The configuration of the new garages or additions are shown in the preceeding chapter on terminals. Except for South Terminal, Logan's garages will continue to follow a hybrid model in functional design. Improvements can be made which will simplify and clarify the system for its users.

Design Criteria. The underlying goals of the garage options which are shown are, first, to increase the flexibility of the parking supply at Logan by interconnecting garages, and second, to establish direct connections between parking areas and the curb at each terminal.

The interconnection of garages with vehicular bridges can answer several needs at the airport. Most important, when one garage is full a driver could go to another garage without re-entering the main roadway. This will reduce the driver's "search time" and lessen the traffic load on the main loop. The interconnection of the garages may also slightly reduce the total number of parking spaces required at the airport. Seasonal peaks for parking vary somewhat from terminal to terminal, and the interconnections will allow any overflow to move easily to another garage thereby reducing the need to build all the spaces needed to accommodate the peak loads at each terminal. The interconnection of garages appears to be most feasible for Southwest and North Terminal and Central Garage. Much longer connections would be needed to interconnect with Volpe parking.

The provision of direct connections between parking areas and the curb at each terminal is a basic functional requirement. In order to conveniently drop off or pick up baggage and passengers at the curb before or after parking, connections must be direct. Such movements to and from Central Garage require a driver to enter the main roadway loop. Returning from Central Garage to any terminal requires use of the MBTA loop to reverse direction, a long and difficult movement during hours of traffic congestion. The need to re-enter the main roadway causes confusion for the many drivers not familiar with the airport and adds to congestion on the road. The connection of curb and parking areas will make the airport much more convenient and build into the system the connections needed to make it function efficiently.

Southwest Terminal

All of the garage options for this terminal include third level vehicular links from the in-terminal parking garage to the Central Garage. This link will allow overflows from Southwest Terminal Garage to go directly to the Central Garage without re-entering the main Terminal Loop. Automobiles would be able to enter and leave the interconnected garages either at Southwest Terminal or Central Garage. Garage entrances would be provided at the upper level (existing entrance) and lower level, and all cars would exit at the lower level. This allows entry to the garage from either level of the terminal loop, which is fully separated into arrival and departure levels.

Recirculation loops at each curb level would allow entry to the garage after upper level drop-off or exit from the garage to lower level curb pick-up. Ramp circulation to accommodate these movements remains to be worked out.

Option 1 involves a garage addition to the front of the terminal as far to the east as possible to avoid obstructing the terminal's landmark appearance from the Terminal Loop. The garage crosses over the Main Roadway at the third level and is attached to the Central Garage. The option provides 1200 new parking spaces on the third to fifth levels.

Option 2 has a new garage attached to the front of Southwest Terminal and fills the site of the present at-grade parking lot. A third level bridge attaches the terminal garage to the Central Garage; 850 new parking spaces are provided.

Option 3 includes a new garage attached to the front center of the terminal, with parking floors of the garage extending across the Terminal Loop and joining the Central Garage; 2000 new parking spaces are created.

Option 4 involves the compete reconstructon of Southwest Terminal in a configuration similar to that of South Terminal. The garage lies parallel to the terminal and is connected by a bridge to the Central Garage; 2600 new parking spaces are provided.

South Terminal

South Terminal presently fulfills the design goals of access between curb and parking and vice versa. The South Terminal garage is an example of the decentralized model with ample capacity for approximately 220% of the 1980 passenger load. The expansion options may be necessary within the next twenty years if the projected increase in passenger traffic occurs.

Option 1 is an extension of the terminal and parking area toward BIF; up to 1100 new parking spaces are added.

Option 2 includes the same extension, and also includes a garage ramp at Pier D which connects to the Central Garage, thus linking South Garage directly to the Central Garage; 1100 new parking spaces are provided.

North Terminal

North Terminal presently has no direct vehicular connection between its curb and parking areas. The configuration of the terminal, the Central Garage (which serves the terminal) and the main Terminal Roadway make the construction of a connection difficult.

Option 1 is the minimum build option and does not contain any additional parking spaces or connections to the Central Garage.

Option 2 includes a new "air rights" parking garage which connects to the Central Garage and has an entrance at Pier A. In addition, a down-ramp connection to the lower level is built between the Central Garage and Pier D. These two improvements allow circulation between the parking areas and the curb at North Terminal. 1000 new parking spaces are added in this option.

Option 3 is the complete rebuilding of North Terminal in a form similar to that of South Terminal. A new parking garage serves part of the parking demand at the two arms of the new terminal. A garage is built over Pier A connecting to the Central Garage, and an exit ramp connects the Central Garage to Pier D. The option fulfills the goal of direct access between curb and all parking; 3450 new parking spaces are provided.

Volpe Terminal

Volpe Terminal is currently served by an at-grade parking lot directly in front of the terminal building. This parking area is adequate during off-seasons. In the peak summer season of 1979, the lot overflowed during international peak hours; added long-term parking demand has been created by the location of New York Air at Volpe, and overflows are expected again in 1981. International travel is expected to grow substantially; therefore, a garage will be needed to accommodate the expected demand. However, much of the parking associated with international travel is short-term parking by companions seeing off or greeting air travelers; thus, a large number of parking spaces are needed only for a short period of time. Special management of the Volpe Garage will be needed to insure its economic viability. One option would be to use part of the garage for employee parking during the first (and busiest) employee shift from 6:00 a.m. to 2:00 p.m. and for short-term passenger parking from 3:00 p.m. on. The management of the Volpe Garage must be examined in greater detail before any of the options is pursued.

Option 1 is the extension of Volpe with perpendicular wings along Pier A and on the west side of the terminal. Volpe and its two wings operate on two levels. A garage is built on the site of the existing parking lot and accommodates direct access to and from the curb. 1400 to 2000 parking spaces can be provided.

Option 1a is identical to Option 1 except the terminals operate on one rather than two levels; garage entry would reflect this difference.

Option 2 involves a new Volpe wing parallel to the existing east-west service road. Garages would be built at both the existing and new wings. Both garages would have direct access to and from the curb; they would accommodate a total of 1400 to 2000 cars.

Option 3 includes a new terminal wing diagonal to the existing terminal and has garages at both the existing and new wings. Both garages would have direct access to and from the curb; combined capacity would be 1400 to 2000 parking spaces.

Central Parking

The Central Garage and lots currently contain 5411 parking spaces (including presently frozen spaces and employee spaces). In order to accommodate the projected year 2000 parking demand, additional parking spaces are needed in the central area as well as at the terminals. The two options which exist for increasing parking capacity in the central area are illustrated in the two airport development packages (Figures 3.4 and 3.5).

Extension of the Central Garage This option, as shown in Figure 3.4, would add a new wing to the existing garage. The extension would hold up to 3500 parking spaces.

Design concerns which arise with such an addition include the location of potential Volpe bypass road and its effect on garage circulation. The potential people-mover system also raises questions about internal garage circulation. Finally, the large mass of such a parking structure is likely to make the garage interior dark and disorienting and require a second vertical circulation system. The garage's exterior appearance would add further to the overwhelming scale of the terminal complex.

Constructon of an Additional Garage The new garage shown in Figure 3.5 would accommodate up to 2500 cars. The garage is in a good location to serve a Volpe extension, the Hilton Hotel and rental ready-car parking needs as well as present Central Garage functions.

This option also raises some specific design concerns including the configuration and location of the Volpe exit ramp and an elevated bus loop both of which would penetrate the Garage and complicate garage circulation.

Employee Parking

Private automobile is the preferred mode of access to Logan Airport by employees of Massport, the airlines, and the other firms and agencies at the airport. Nearly 88% of all employees come to work by car, and 91% of these auto users were the drivers of the vehicle used, indicating a high proportion of single passenger vehicles. On an average day in April 1979, 9010 employees parked 7523 automobiles at the airport. Because of the several employee shifts, these cars were accommodated in 2880 parking spaces.

Employee parking is widely dispersed at the airport (See Figure 7.1). There are major employee parking lots operated by Massport (1258 spaces), Delta (552), Eastern (314), TWA (273) and American (240). Smaller parking areas ranging down to five spaces are located near facilities throughout the airport. The total of all large and small parking areas is presently 3100 spaces. In many instances, these spaces are also used by non-employees, such as sales representatives and airfreight customers doing business at the airport.

Surveys of employees and employers were conducted by CSI, Inc., who concluded that employee auto use would be difficult to discourage. In the present master plan study, it is assumed that a maximum of 15% diversion of the automobile mode share is possible.

The number of employees at the airport may increase almost in direct proportion to the volume of passengers and cargo handled, although airlines are attempting to increase productivity. Based on the cargo and passenger forecasts used in this study, year 2000 employees would number approximately 2.6 times the present number. Assuming a 15% diversion in employee automobile volumes, the number of parking spaces needed to accommodate them would increase by a factor of 2.2 to 6300 spaces, an increase of 3400 spaces.

It is currently being considered to build a remote parking lot for 2200 cars in the area adjacent to Wood Island MBTA Station; these spaces would in the short run substitute for existing employee spaces in the Central parking area to relieve traffic congestion. In the long run, employee parking may again be needed in the central area as well as in parking lots at Bird Island Flats facilities and in the Southwest Service Area. At the point when employee parking begins to compete for site area with public and car rental parking, structured parking must be considered. Parking fees for employees would probably need to be increased to cover the cost of parking structures; this may, in turn, discourage some employees from using automobiles but others may find parking spaces off-airport, which may cause community impacts. Off-airport zoning should be prepared in advance to prevent parking lots in inappropriate locations, and Massport should monitor the parking situation periodically.

Chapter 8 Roadways

The roadway system at Logan serves several kinds of traffic. The primary function of the roads is to carry airline passenger traffic between the highway and the terminals. The secondary purpose is the carrying of commercial traffic, such as freight bound to or from an airplane or rental cars. The third purpose of the roads is to carry airport service and maintenance vehicles and employee traffic. All three functions share portions of the existing road system. Options for a future roadway scheme have concentrated on separating terminal-bound passenger traffic from commercial and service vehicles. The aim of this separation is to ease the flow of traffic on the Terminal Loop and reduce delays at the intersection of the Loop and the North/South Service Road.

Options for improvement of the roadway system at Logan have been broken down into three fairly distinct parts; one, the western end of the airport loop with its ramps to and from the highway and the intersection with the North-South Service Road, second, the Terminal area of the airport, third, the entrance and exit ramps to C-1 from Neptune Road. Coordination of improvements for these areas is discussed in Chapter 10.

Existing Roadway System

Logan's existing roadways are shown in Figure 1.2. Major highway access and egress is via the MDPW ramps which connect directly with the Inbound and Outbound Terminal Roadways; the loop these roads form is the primary roadway system, serving most passenger related traffic.

The North-South Service Road forms an intersection with the Terminal Roadways. The Service Road connects with highway access/egress at Neptune Road which is used by about 45% of the airport's commercial truck traffic. An East-West Service Road branch serves the southern edge of the North Apron, and Prescott Street serves its northern edge.

The North-South Service Road branches into secondary roads which provide access to the Southwest Service Area and connects to Porter Street. Porter Street serves as a secondary truck access/egress route and a bypass route for automobiles and taxis seeking to avoid congestion at the intersection on the Terminal Loop.

Terminal Roadway Loop

Traffic is oriented to both terminal and employee parking. Terminal traffic is heavy from 6:00 to 10:00 a.m. and from 2:00 to 9:00 p.m. with heaviest volumes at 8:00 a.m. and 6:00 p.m. Employee traffic is heaviest from 6:00 to 8:00 a.m. and 2:00 to 5:00 p.m. Because of parking, inbound traffic is heavier than outbound in the morning, and the reverse is true in the afternoon. Employee vehicles account for 30% of the morning peak hour traffic.

In the April 1979 morning peak hour, approximately 2500 vehicles entered the Terminal Roadway Loop, with roughly equal volumes bound for the Central Parking area, Southwest, South and North Terminals; there was almost no traffic to Volpe at this hour. Outbound morning traffic was approximately 1400 vehicles; the difference from Inbound traffic, 1100 vehicles, were parked.

Forecast Traffic

Assuming that traffic increases are proportional to passenger increases and that the forecasts are accurate (see Chapter 5), traffic would increase to 2.6 times present levels by the year 2000. Assuming further that automobile traffic can be reduced 15% to 20% through efforts to encourage other modes of access, inbound morning volumes would reach 5000 vehicles per hour; this could be accommodated in four traffic lanes, one more than exists now. In the roadway section between South and North Terminals, volumes would be approximately 3300 vehicles per hour, with roughly half that volume weaving out from South Terminal and into North Terminal.

Weaving capacity cannot be significantly increased by widening the roadway, but the existing weave distance which would be barely adequate, should be maintained. The existing five lanes in the terminal loop (two above, three below) are adequate for the total volume of projected traffic; however, upper level traffic may exceed the two lane capacity of 1600 to 2000 vehicles per hour during hours of concentrated departures. Addition of a third lane would be desirable but is not essential, since upper level congestion would simply cause traffic to divert to the lower level.

Main Intersection of Terminal and Service Roads

Capacity on the Inbound and Outbound Roadways is constrained by the traffic signals at the double intersection with the North-South Service Road. The intersection can handle an estimated maximum of 2300 vehicles inbound and 1900 outbound vehicles per hour. The major limiting factor is that only 47% of the signal phase

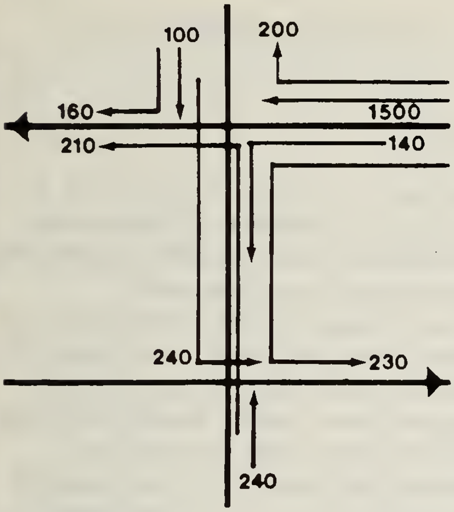


Figure 8.1

Traffic at Outbound Roadway/ Service Road Intersection

is allocated to the principal movements. The remaining signal phase is needed to handle north-south traffic (including short-cutting to or from Porter Street) and U-turns from the Outbound to Inbound Terminal Roadway. In the June 1980 afternoon peak hour, estimated major traffic flows are as follows for the more congested, northern half of the intersection.

Table 8.1

Traffic at Loop Roadway/ Service Road Intersection

Movement	Peak Veh. per Hour
Outbound Roadway	
- Through	1500*
- Right turn to northbound	200
- Illegal left turn for U-turn	230*
- Illegal left turn for Porter/SW Area	140*
	2060
Northbound	
- Through	240
- Left turn to outbound	210*
	450
Southbound	
- Through to Porter/SW Area	100*
- Through for U-turn to inbound	240*
- Right turn to outbound	160
	500

Inbound morning peak hour movements are roughly symmetrical with outbound movements as regards the through movement and traffic from Porter Street.

There are a variety of truck movements through this intersection. The direction of these movements depends on the routes traveled by various trucks, whether they include destinations in both the North and Southwest Service areas, and whether their origin is north of the airport or through the Callahan Tunnel. Truck movements are numerically a small percentage of all vehicle movements at the intersection, but are functionally highly important for the movement of cargo.

Forecast Traffic

The Inbound and Outbound Roadway frequently reach capacity at the intersection, and thus cause delays. Forecast growth in peak hour traffic, after all measures have been taken to discourage automobile use, would be approximately 150 additional vehicles per hour each year. Bird Island Flats development could, by 1987, add 500 outbound auto trips and 15 outbound truck trips in the afternoon peak hour. These increases would clearly lead to unacceptable delays within five years if no measures are taken to increase capacity.

Porter Street and Maverick Street

The use of Porter Street by airport traffic represents a traffic and environmental issue that relates to the main intersection of the Terminal Roadways and Service Road and to the local neighborhood. Porter Street presently provides access for employee and truck traffic between the harbor tunnels and the Southwest Service Area. It also provides a bypass to congestion at the main intersection for employees, airline passengers, and taxis bound for the terminals, Central area and North Apron parking areas. Porter Street would be the preferred route to the tunnels from Bird Island Flats until congestion at the Chelsea Street traffic signal increases to the point that the main airport intersection and highway ramps become a preferable route.

Eliminating Porter Street as an access point to the airport has some environmental benefits for the community. It would prevent the increase of BIF-related and passenger-related traffic in the neighborhood, and discourage the location of airport-related uses such as freight forwarding and car rental on neighborhood streets.

Two potential disadvantages of closing Porter Street access must be considered. First, in the short term, traffic from airport-related uses will find new, longer routes into the airport and thereby cause impacts in new areas. Second, traffic patterns at the main airport intersection will change and signal phase adjustment will be necessary. Whether capacity at the intersection is thereby increased or reduced depends on the balance between the two types of traffic now using Porter Street: in the afternoon peak hour, for instance, closing Porter Street access would eliminate southbound movements by outbound short-cutters but add northbound left turns by outbound Southwest Service Area traffic. It is believed that the short-cutting vehicles are the more numerous group and that excess capacity would therefore be created which could be added to the outbound Terminal Roadway signal phase. Congestion on the highway ramp to the Sumner Tunnel should not change if Porter access is closed, since capacity is constrained by the tunnel toll plaza, not the merging movement on the ramp itself. The shifting of tunnel traffic from Porter Street to the highway ramp would not affect the toll plaza congestion which causes back-ups on the ramp.

It is recommended that the foregoing assumptions be checked by Massport and that closing Porter Street access be seriously considered by Massport and the Jeffries Point community.

Maverick Street is presently a minor egress point from the airport. The case is strong for closing this egress from the airport for environmental reasons.

Neptune Road

See Figure 8.17

Neptune Road is the principal access and egress point to C-1 for trucks and is used heavily by employees, a majority of whom live north of the airport. This street also serves as an airport exit when Sumner Tunnel toll plaza congestion leads to back-ups which block both highway ramps on the Outbound Terminal Roadway.

Connections at Neptune Road to and from the tunnels is direct, via highway ramps; access to the outbound ramps is sometimes blocked by traffic queues at the Bennington Street/Neptune Road traffic signal. Connections to and from the north are long and circuitous, requiring use of Bennington Street and left turns on Swift, Curtis, or Moore Streets from which there is access to northbound Route C-1. These streets are primarily residential. Southbound traffic from Route C-1 must use Chelsea Street and pass through the Day Square area to reach the airport. Within the airport, service road circulation is circuitous between Neptune Road and the main intersection with the Terminal Roadway. Access to the Marriott kitchen facility has been routed on airside via the North Security gate to avoid impacts on Frankfort and Lovell Street residences.

Traffic capacity in each direction via Neptune Road may be on the order of 1400 vehicles per hour in the highway ramps plus 700 to 1000 vph on the several routes to or from the north.

The peak hour one-way volumes at Neptune Road are forecast to reach 930 vehicles per hour in year 2000 without auto diversion measures or 820 with maximum auto reduction measures in effect. In contrast, the two-lane service road connection to Neptune Road has a capacity of at least 850 vehicles per hour and the four lane section of Neptune Road has capacity at least equal to the off-airport roadways with which it connects.

The unused capacity can, however, be exceeded in a number of ways. Construction of a remote parking lot near Neptune Road could add 400 or more automobiles in the morning peak hour; these vehicles would use only a short section of the two-lane service road. Diversion of outbound terminal traffic when the main highway ramps are congested could add 1000 vehicles per hour or more at the year 2000 forecast level, far in excess of the two-lane service road capacity. Neptune Road could also be used as the sole truck route for the airport; this would cause a modest increase in year 2000 of roughly 100 trucks per hour or 200 equivalent vehicles per hour. The total Neptune Road peak hour traffic could thus reach 1200 to 1400 vehicles per hour with the existing two lane service road south of Prescott Street and 2000 vph or more with a realigned four-lane service road. Improvements to handle traffic of this magnitude are described below.

Options for North/South Service Road Separation

The eight schematic roadway options developed for the western end of the airport were designed to improve east-west and north-south access. Maintenance of clear and efficient links between the east-west and north-south routes presented the most difficult problems for design. Access from BIF and the Southwest Service Area to C-1 and Sumner tunnel also presented particular design problems. Solutions to this movement were achieved in three ways: a) traffic signals (Options 1 and 2), b) circuitous routes for traffic (Options 3, 4, 5, and 8), and c) ramp systems (Options 6 and 7). Although the movement can be made in all of the alternatives, it is accomplished at a cost of delay in traffic flow or major investment.

The question of North Apron layout and access from the terminal and Williams Cargo area to Neptune Road arises as part of any discussion of airport circulation. Most of the options (1, 4, 5, 6, 7, and 8) include a new alignment for the service road as it runs along the western edge of the North Apron. There are several sub-options for access through this part of the airport, all of them compatible with each of the eight options. These sub-options are discussed below. Where the realignment of this portion of the service road is included, the cost of that short section of new road is included in the estimated cost of the option.

None of the schemes is a "perfect" solution; each has advantages and drawbacks. The diagrams and brief descriptions of each scheme outline their main features. Order of magnitude costs accompany each option. Costs of detours, property acquisition or re-negotiation of leases are not included.

Following the individual descriptions is a comparison of the schemes based on circulation efficiency, difficulty of implementation, and cost. The evaluation of the schemes also includes the major issues regarding construction staging, property acquisition and lease re-negotiations.

OPTION 1
MINIMUM BUILD

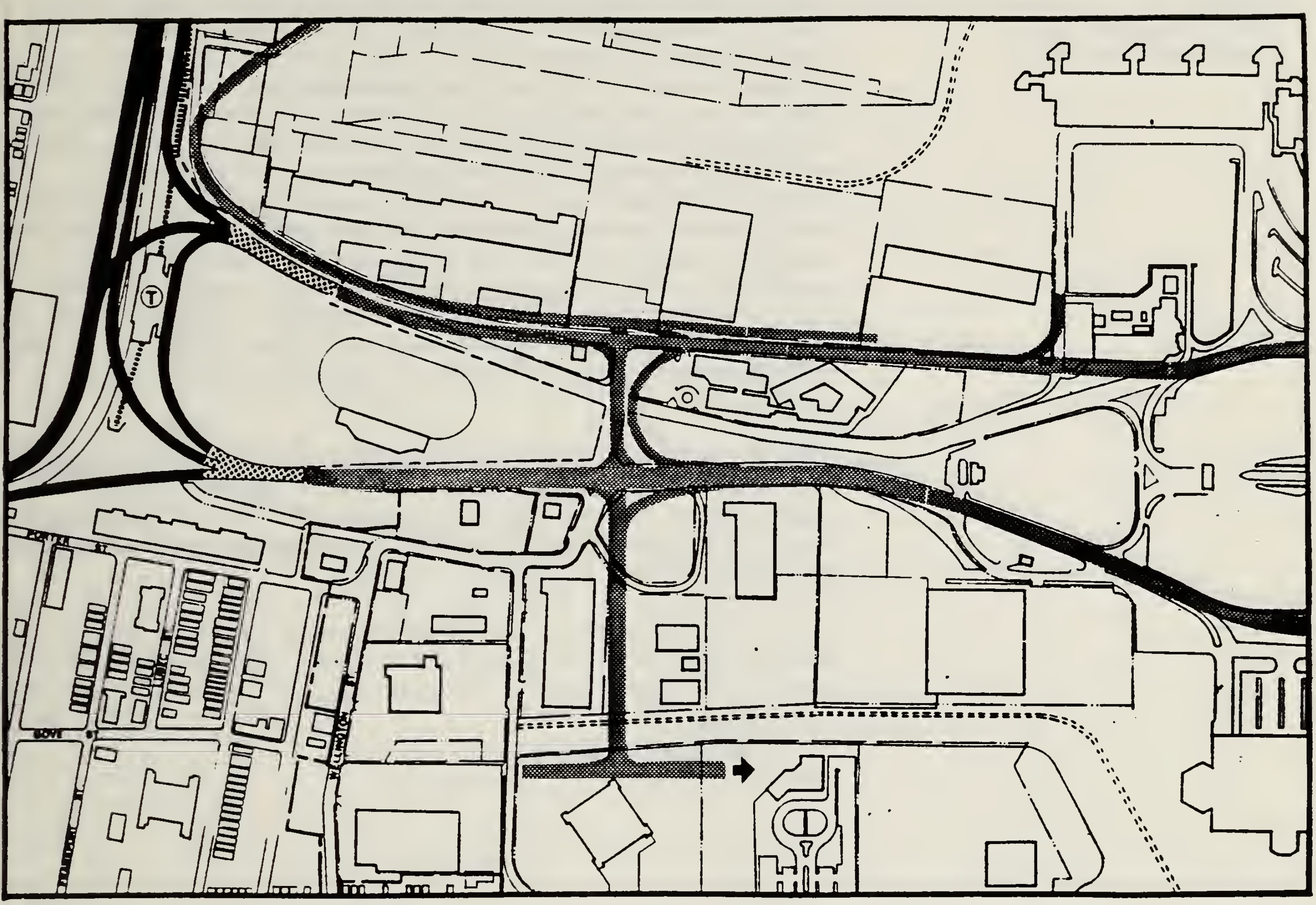
The Minimum Build Option relocates outbound traffic from its present alignment to the existing service road alignment north of the Hilton. A new service road, parallel to the existing one, will be built to serve the cargo and hangar facilities along the North Apron. Traffic signals re required at the intersections of the N/S Roadway with the Inbound and Outbound Terminal Roads.

The stacking distance on the North/South Road between the Inbound and Outbound Roads is increased, an unsignalized recirculation loop is provided, and a free right turn lane is included for inbound traffic wishing to go to BIF or the SW Service Area.

These minor improvements allow a slight modification in signal phases to be made with the major east-west flow gaining 10-20% of each phase. This increases the capacity of the Inbound/Outbound Roadways enough to accommodate the traffic load projected to 1985.

The minimum build as illustrated does not include a bus loop to the MBTA station which is separated from the main traffic flow. However, the road configuration would easily permit a bus loop to be constructed in the right-of-way below the existing highway ramps. This would remove buses from the main loop flow and permit them to bypass the congestion which frequently occurs at the ramps to the highway and tunel. However, the new bus loop would raise 4(f) issues by interfering with access to the East Boston Athletic Field.

Estimated Cost:	Without Bus Loop	$1.4 Million
	With Bus Loop	$1.5 Million



Road Separation, Option 1: Minimum Build

Figure 8.2

▩ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

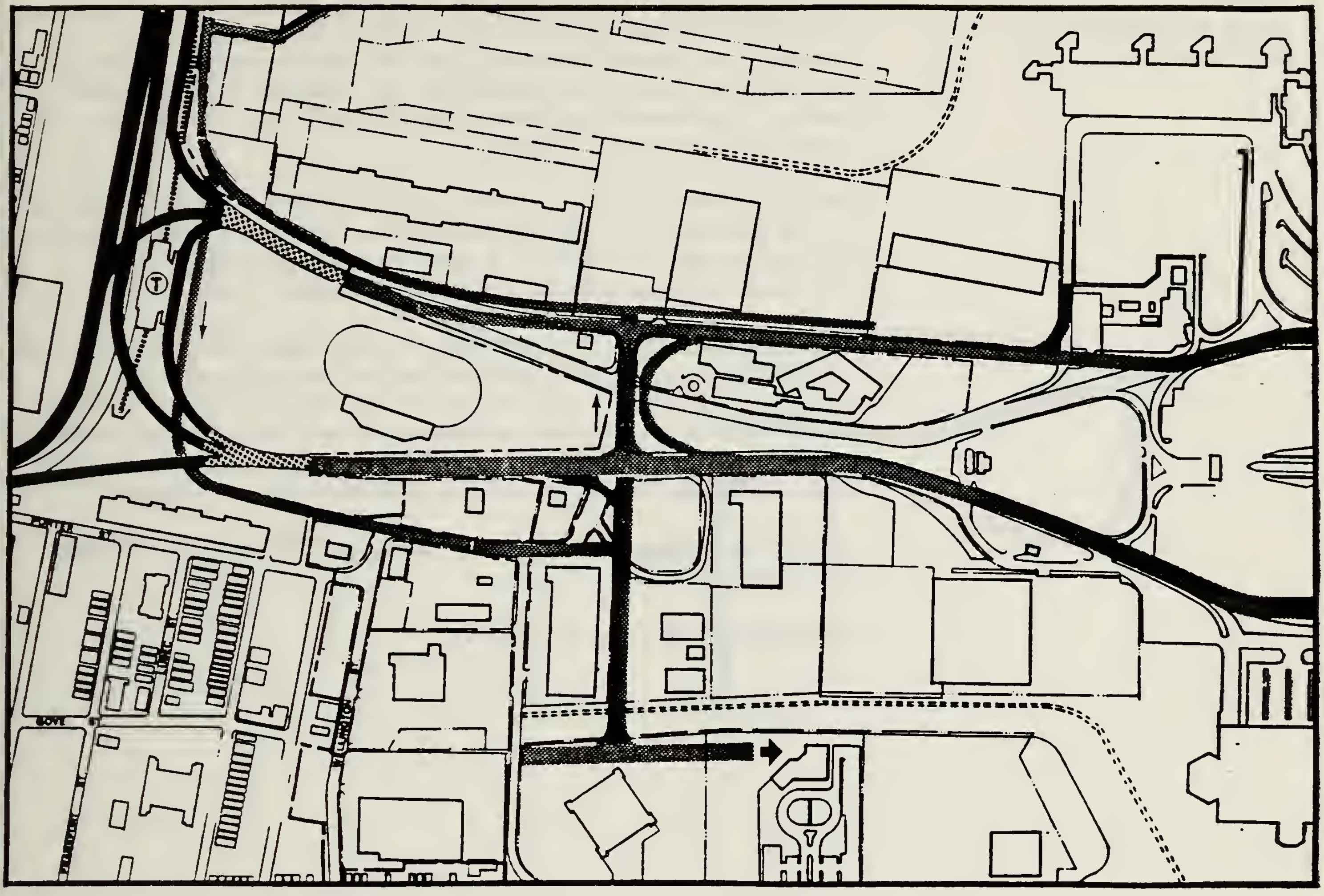
OPTION 2
WEST ALIGNMENT SB, INTERSECTION NB

This option provides a new southbound road in the right-of-way below the existing highway ramps which would carry autos and trucks going from the North Apron or terminal area to BIF and the Southwest Service Area. The road would also serve as a bus loop for the MBTA station. Northbound traffic from BIF and the SW Service Area uses a one-way road which crosses the Inbound and Outbound Terminal Roadways at an at-grade, signalized intersection. The Outbound Roadway follows the alignment of the existing east-west service road and a new service road is built parallel to its present alignment. This option provides increased stacking space on the northbound service road, an unsignalized recirculation loop and a free right turn lane for eastbound traffic headed for BIF and the Southwest service area.

The improvements will allow a slight modification in the signal phases of the lights which will add 10-20% of the signal phase to the east-west movement. This increases the capacity of the Inbound/Outbound Loop enough to accommodate the traffic load projected to 1985.

Because traffic under the highway ramps would be much heavier than for a dedicated bus loop, the negotiation and 4(f) issues [historic, recreational, and cultural] involved are more serious.

Estimated Cost: $1.1 Million



Road Separation, Option 2:
Intersection North Bound, Road Below Ramps South Bound **Figure 8.3**

■ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

OPTION 3
WEST ALIGNMENT SB,
OVERPASS NB

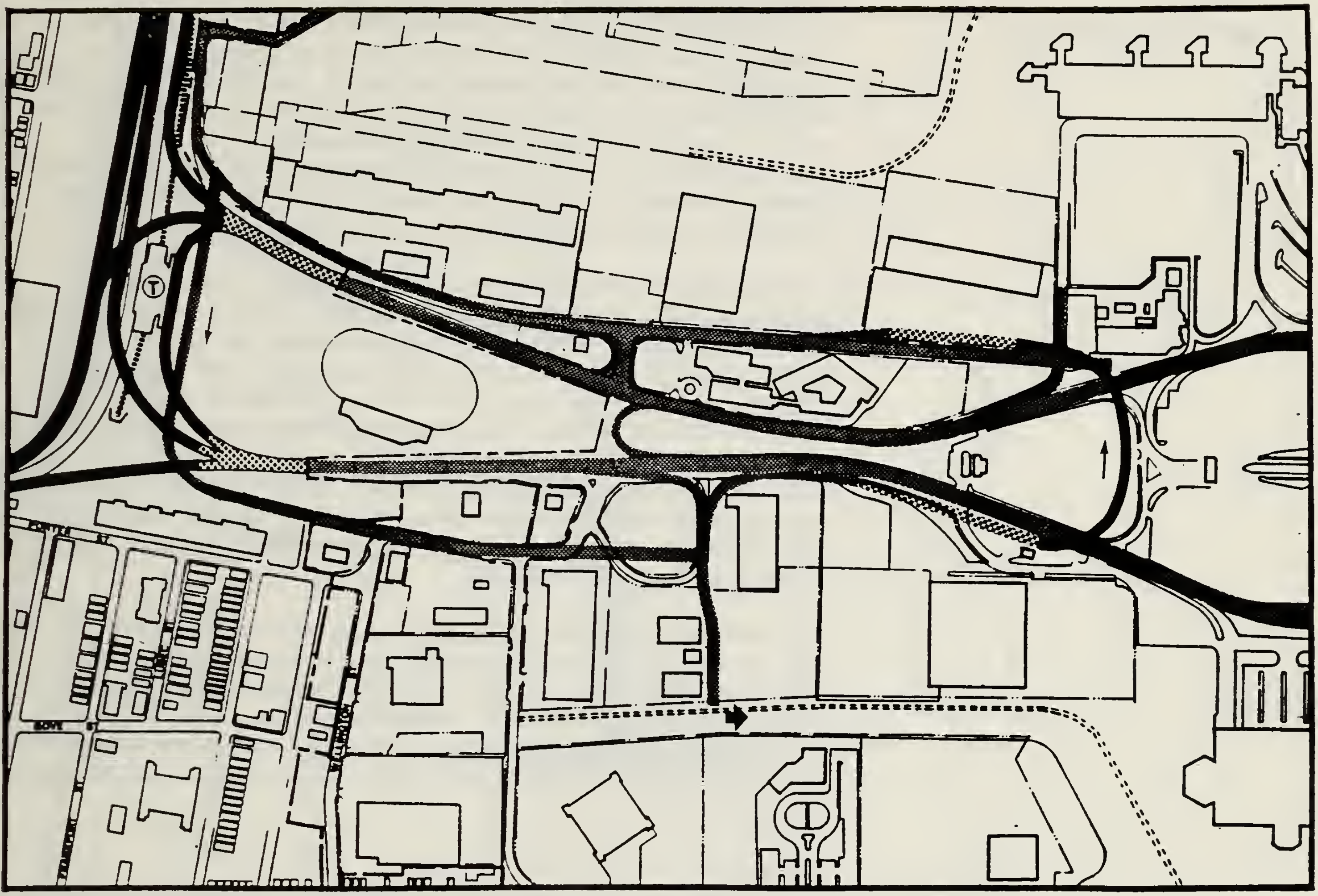
This option has a southbound roadway under the existing highway ramps, and a bridge crossing over the Inbound and Outbound Roads east of the Hilton. There are no traffic signals required on the Inbound and Outbound Roads. East-west and north-south traffic are largely separated into two systems.

The alignment of the Inbound and Outbound Roads remains as it is presently. The East-West Service Road also maintains its existing alignment. A free recirculation loop is provided between the Outbound and Inbound Roads.

The intersection of the bridge's down ramp with the service road will require a modification in the service road layout. Although some of the north-south traffic movements which this alternative accommodates are circuitous, all the necessary movements can be made without interfering in the east-west traffic flow on the Inbound/Outbound Loop.

As in Option 2, right-of-way negotiation and 4(f) issues are involved.

Estimated Cost: $5.4 Million



Road Separation, Option 3
Bridge Loop North Bound, Road Below Ramps South Bound Figure 8.4

■ At Grade Roadway

▨ Ramp

■ Elevated Roadway

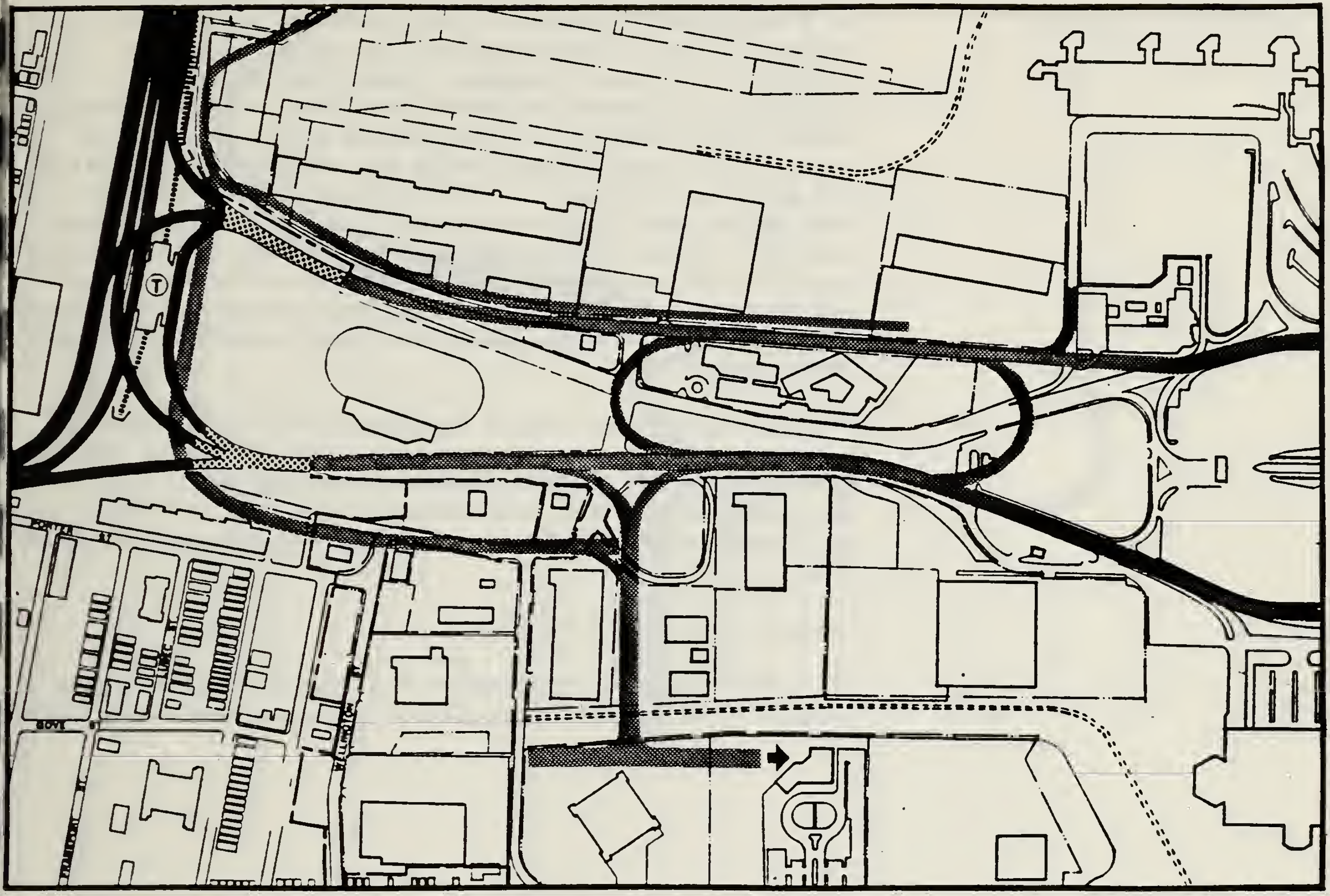
OPTION 4
WEST ALIGNMENT NB & SB

North-south traffic is accommodated in this option with a two-way road under the existing highway ramps. The Inbound Road remains in its present alignment and the Outbound Road is relocated north to the present alignment of the East-West Service Road and a new service road is built parallel to its existing alignment. A free recirculation loop is provided between the Outbound and Inbound Roads. No traffic signals are required on the Inbound or Outbound roads in this scheme.

Two movements are particularly difficult under this alternative. Access from BIF to the highway and from the Callahan Tunnel to the North Apron must be achieved by getting on the Inbound Road and weaving onto an at-grade connection between the Inbound and Outbound Roads. For traffic from BIF this movement involves weaving across the three inbound lanes of traffic in a distance of 1500 feet. The construction of the connecting road for these movements will change the land use possibilities of the site that is now used for the ready-car lot by cutting off its direct access from the terminals.

The greatest difficulty which this option may face is the use of the right-of-way under the highway ramps for a two-way road. This would probably require the taking of some parkland to provide adequate width. There is a discussion of "4(f)" issues following the description of all the options; that discussion is particularly relevant to this option.

Estimated Cost: $1.9 Million



Road Separation, Option 4:
Two Way Road Below Ramps

Figure 8.5

▩ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

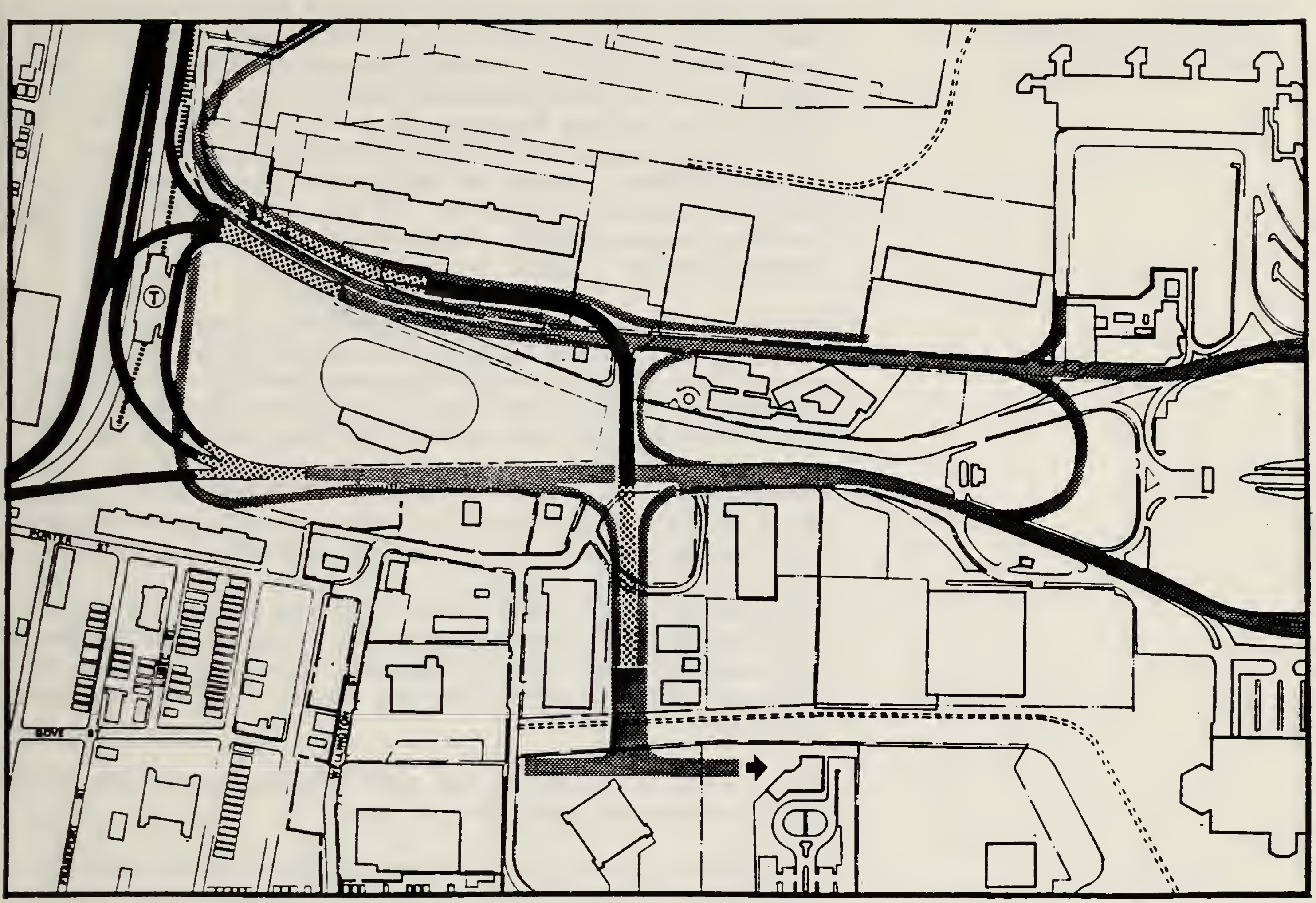
OPTION 5
NORTH/SOUTH BRIDGE

The main feature of this option is the construction of a north-south, two-way bridge over the Inbound and Outbound Roads in approximately the location of the existing north-south roadway. The Inbound Roadway maintains its present alignment and the Outbound Roadway assumes the alignment of the present east-west Service Road. A new service road would be constructed parallel to its existing alignment. A free recirculation loop is provided between the Outbound and Inbound Roads. Access from BIF to the highway and from the highway to the North Apron can be achieved by getting on the Inbound Roadway, and exiting onto an at-grade connection between the Inbound and Outbound Roadways, having the same problems described under Option 4.

This option suffers from a number of poor connections, particularly from the North Apron to the Terminals and the tunnel, and from BIF to the tunnel and the south side of the North Apron. The introduction of a ramp into the Southwest Service area greatly impedes circulation in that area.

Estimated Cost: $15 Million

This option is not recommended for further consideration because of the severe circulation problems mentioned above.



Road Separation, Option 5:
North-South Bridge

Figure 8.6

▩ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

OPTION 6
PARTIALLY ELEVATED EAST-WEST ROADWAY

This option connects both the Inbound Roadway and entrance ramp and the Outbound Roadway and exit ramp with elevated roads that cross over the North-South Service Road. The Inbound and Outbound Roadways ramp to grade just east of the crossing of the North-South Road. A recirculation loop is provided between the Outbound and Inbound Roadways. The Inbound Roadway remains in its present alignment, and the Outbound Roadway is moved to the present alignment of the East-West Service Road. A new service road is provided parallel to its present alignment.

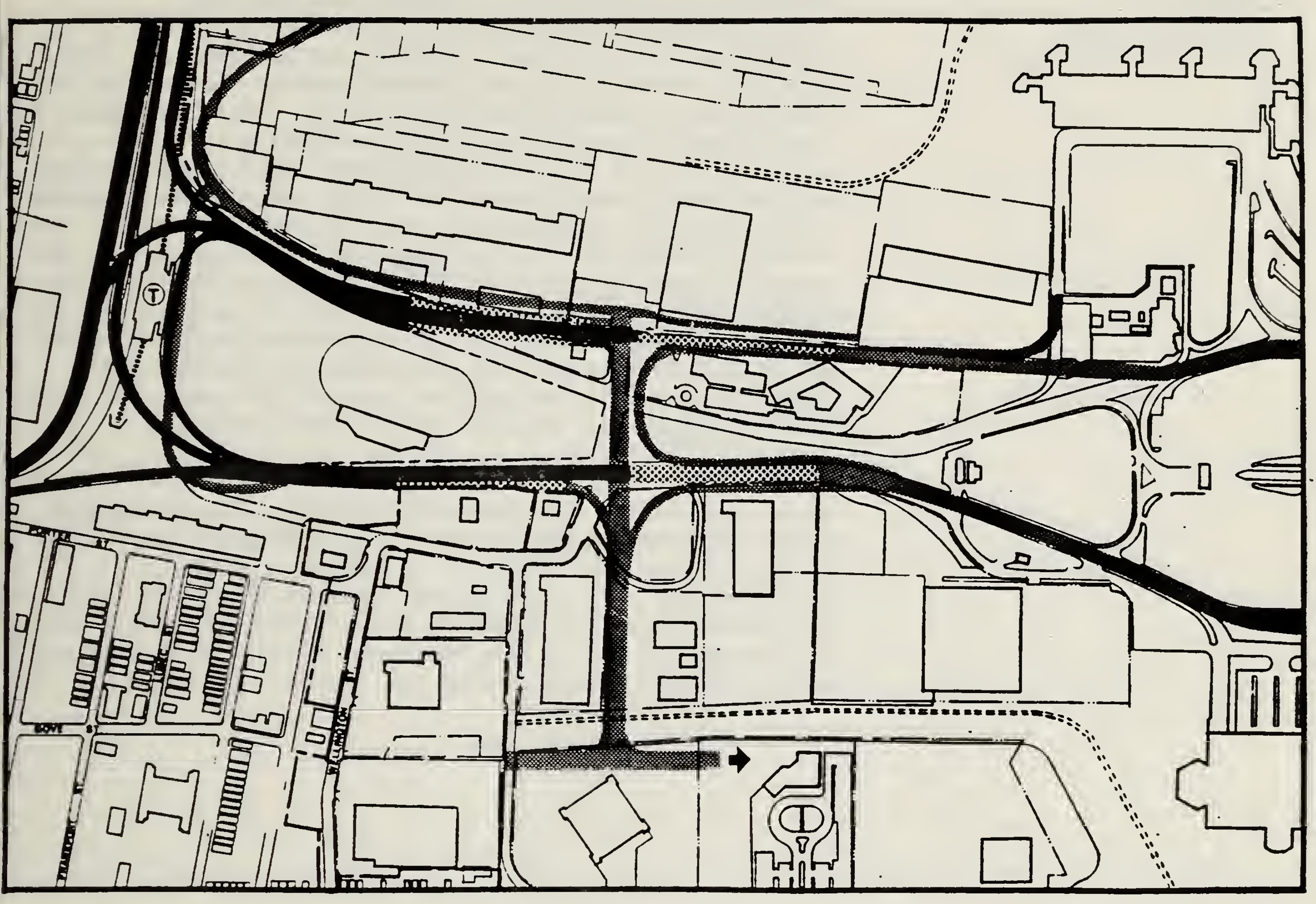
Signalized intersections are required at-grade for connections to the at-grade North-South Service Road, but they do not interfere with east-west traffic flow to the terminals. Access from BIF and the Southwest Service area to the highway is provided by a pair of ramps to the elevated Outbound Roadway; one ramp is provided for southbound traffic, and one for northbound. Traffic on the Outbound Roadway will be divided between northbound and southbound (Sumner Tunnel) lanes before the BIF traffic joins it

This option serves most of the required movements quite well, although traffic entering the airport from the north and headed for BIF or the Southwest Service Area must weave across entering traffic from the tunnel over a distance of only 700'.

The at-grade bus loop to the MBTA station raises the 4(f) issues discussed under Option 1.

Construction staging for the connections to the existing highway ramps is very difficult, particularly if City of Boston property cannot be used for a detour during construction.

Estimated Cost: $29 Million



Road Separation, Option 6:
Partially Elevated Terminal Roadway

Figure 8.7

■ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

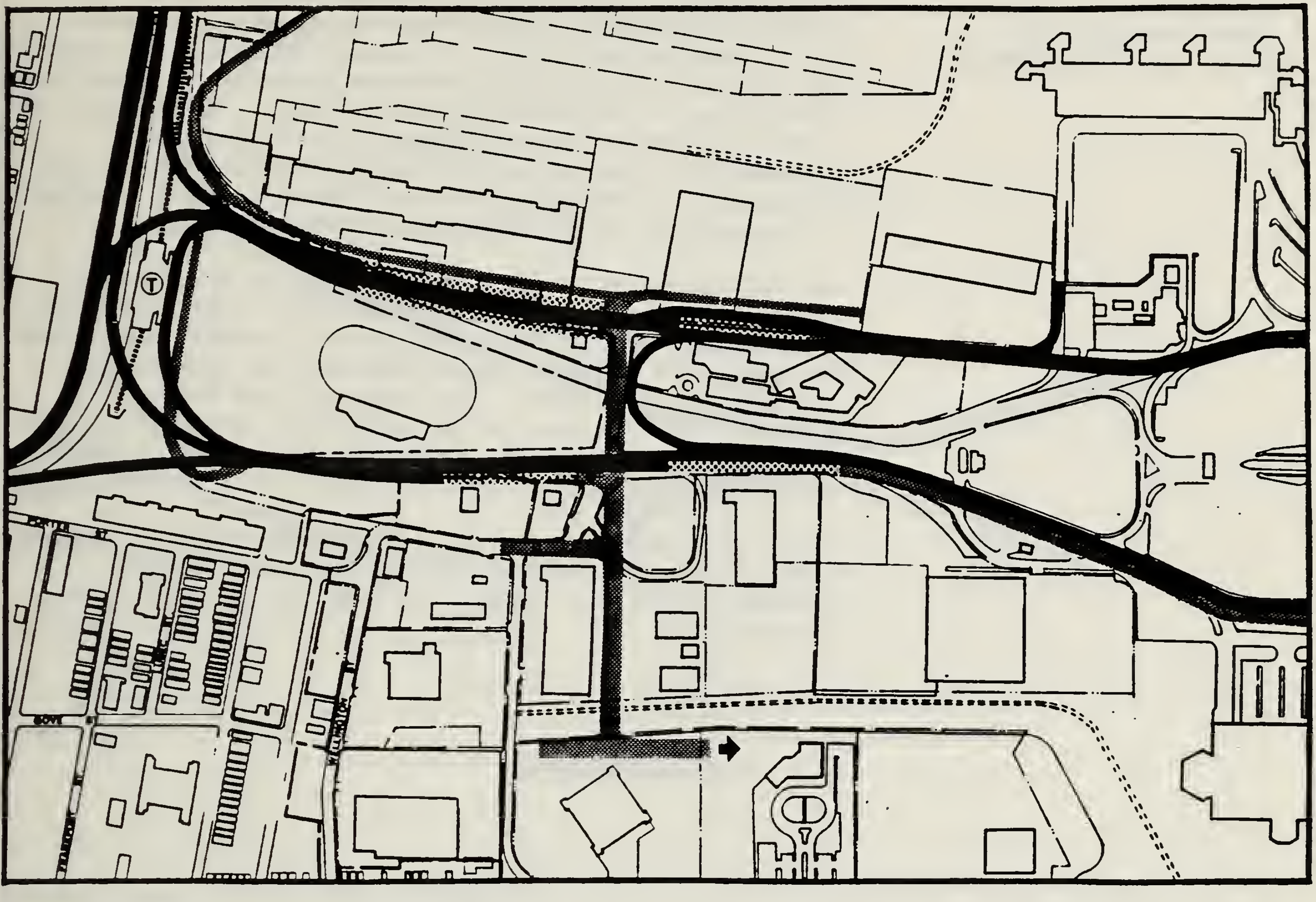
OPTION 7
FULLY ELEVATED
EAST-WEST ROAD

This option connects the ramps to and from the highway with a two-level road system serving the terminals. The roadway is fully elevated from its entry from the highway onto the Inbound Roadway to its exit to the highway from the Outbound Roadway. After crossing over the NS Service Road, the Inbound Roadway splits into a two-level system with the upper level serving departures and the lower level serving arrivals and service vehicles. The North-South Road passes under the east-west loop, and connections between the two are achieved with ramps. The movement from BIF and the Southwest Service area to the highway and tunnel is made with a pair of ramps, one for southbound traffic and one for northbound traffic as in Option 7. Outbound traffic is similarly divided. A recirculation loop is provided on both the upper and lower levels between the Outbound and Inbound Roadways.

Circulation between the North Apron and Southwest Service areas is provided at-grade with signalized intersections where the ramps to or from the elevated road join it.

This option serves most of the required movements well. As in Option 7, traffic entering the airport from the north and headed for BIF or the Southwest Service Area must weave across entering traffic from the tunnel.

Esimated Cost: $40 Million



Road Separation, Option 7:
Fully Elevated Terminal Roadway

Figure 8.8

■ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

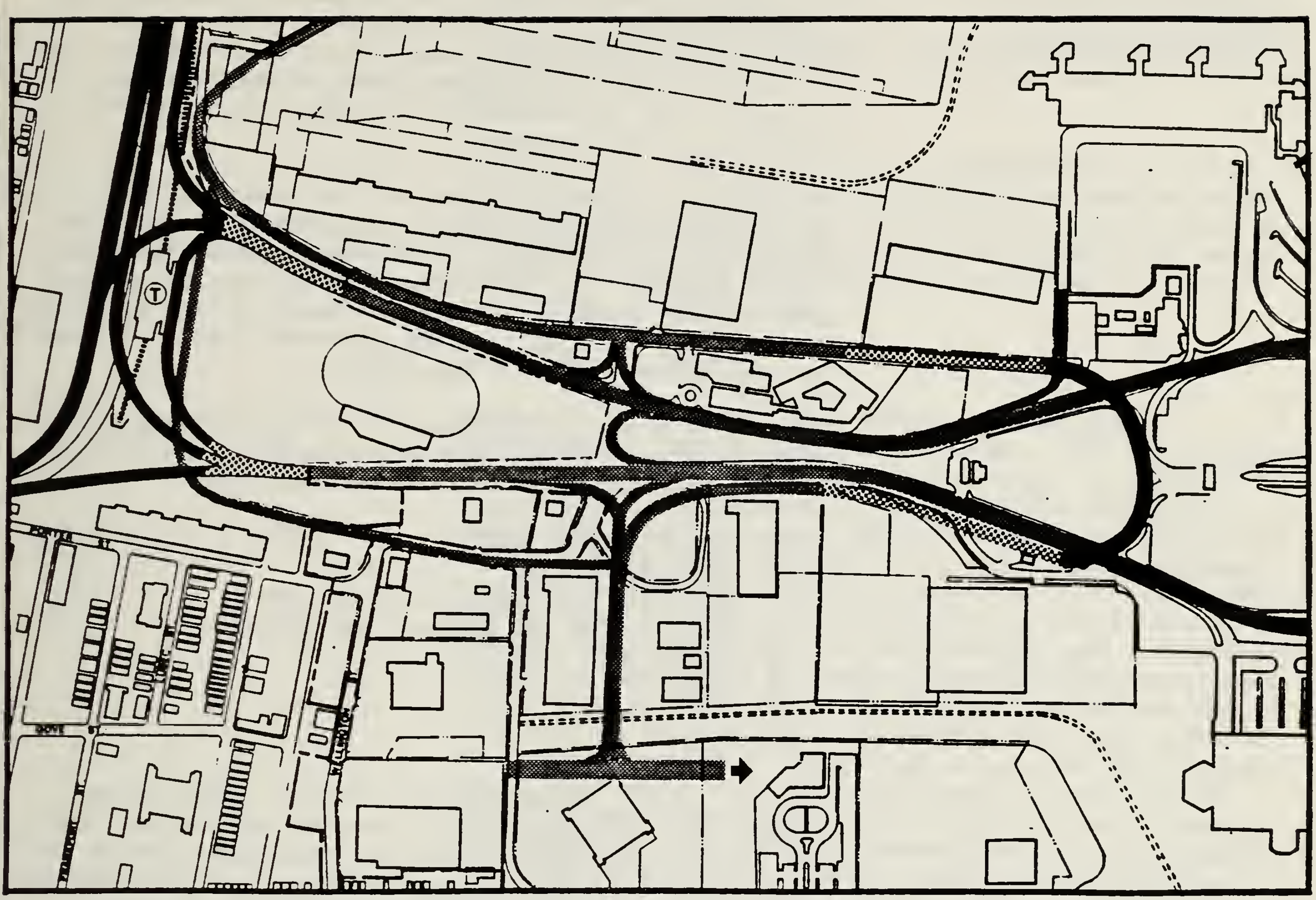
OPTION 8
NORTH-SOUTH BRIDGE ON AN EASTERN ALIGNMENT

This option consolidates north-south traffic on a two-way bridge that crosses over the Terminal Roadways east of the Hilton Hotel. The bridge ramps run parallel to the Terminal Roadways and therefore does not interfere with circulation in the Southwest Service area. The Inbound and Outbound Roadways are maintained at their present alignments. A recirculation loop is provided between the Outbound and Inbound Roadways. Intersections are provided at connections to the North-South Road.

Several movements are fairly circuitous in this option. Traffic from the Neptune Road area to the terminals must use the highway to make that movement. Traffic going from the tunnel to the North Apron must use the Neptune Road entrance to the airport. The movement from BIF or the Southwest Service area to the highway is somewhat circuitous, but does not require weaving through inbound traffic as in Options 4 and 5.

There is a complex intersection where the terminal Inbound Roadway connects with the North-South Service Road, although no traffic signals are required on the Inbound Roadway.

Estimated Cost: $11 Million



Road Separation, Option 8:
Two Way Bridge Loop

Figure 8.9

▓ At Grade Roadway

▨ Ramp

■ Elevated Roadway

0 600 1200 feet 2400

Evaluation of the Roadway Options

The primary traffic flow at the airport is east and west between the highway and the terminals. This is the movement which carries the great majority of vehicles and is the one which is in greatest need of amelioration. The success of the options should be judged with particular attention to this movement.

The secondary movement desired at the airport is the north-south connection between the northern and southern service and apron areas. In addition, access from these service areas to the terminals, and from the terminals to these service areas is important. These service movements involve fewer vehicles than the passenger traffic but are critical to the airport's functions.

In addition to the requirements for improved circulation a number of other factors must be evaluated for each option. The most important criteria are the following:

- Environmental impacts
- Land use impacts
- Interface with other airport plans
- Construction and staging requirements
- Off-airport issues
- Cost

Circulation

Options 1 and 2, which require a traffic light on the Inbound and Outbound Roadways, function well except that they do not completely resolve the congestion problem on the main traffic route. Some increase in signal phase for the east-west movement can be gained from the roadway improvements and it is estimated that either of the Options would provide adequate capacity to 1985.

Options 3 and 4 provide adequate access for most of the required movements, although some movements are fairly circuitous or involve less than desirable weaving distances. The capacity for the major east-west movement is increased in both these options and no traffic signals are needed on the Inbound or Outbound Roadways. Both of these options present land use and environmental problems, which are discussed below.

Option 5 does not adequately resolve the circulation problems of the airport. Many movements are very circuitous and cannot be achieved without additional land takings and awkward road alignments. Access to and from BIF and the Southwest service area and to and from the North Apron is difficult because of the need for transition from ground level to the bridge in a short distance. Circulation within the Southwest Service area is seriously impeded by the bridge ramp.

Options 6 and 7, the partially and fully elevated east-west roads, are successful in meeting the circulation needs of te airport. The movement of cars coming from the north and wishing to go to BIF involves weaving across entering traffic from the tunnel, but this problem occurs in all the options.

Option 8 also answers most of the requirements for airport circulation. One exception is for vehicles wishing to go from the North Apron to the terminals; this move cannot be accomplished without going from the North Apron out to the highway via Neptune Road and then re-entering the airport at the main entrance ramp.

Environmental Impacts

Option 1, the minimum build option, has the least environmental impact of all the schemes. If a new bus loop is not constructed below the existing loop, this option will not have any impacts on the East Boston Athletic Field, which is 4(f) land. All the other schemes have some impact on 4(f) land. Options 2, 3, and 4 have a roadway carrying auto and truck traffic which utilizes land below the existing highway ramps. In Options 2 and 3 this is a one-way road; in Option 4 it is a two-way road. Of primary concern is the impact on access to the athletic field when a road carrying auto and truck traffic lies between the neighborhood and the field. Options 1 (with bus loop), 5, 6, 7, and 8 have only a dedicated one-way bus loop in this area. This would interfere with access to the athletic field but to a lesser extent than Options 2 and 3 because bus traffic is much lower in volume than general southbound truck and auto traffic. Option 4 would have yet higher traffic volumes than 2 and 3 and would require some park land to provide an adequate right-of-way for two-way traffic. The schemes with an elevated east-west road would also cast some shadow on the park.

All of the options except 1 and 2 will have the effect of permitting large traffic increases to be accommodated without congestion.

Option 5 includes a ramp carrying a substantial quantity of truck traffic relatively close to the Jeffries Point neighborhood. This would have a significant noise impact on the neighborhood.

All of the options which make use of any elevated structure (2, 3, 5, 6, 7, and 8) will have visual impacts on the airport. The elevated structures for Options 5, 6, and 7 will be clearly visible from parts of the Jeffries Point neighborhood.

Land Use Impacts

All of the options will have some impact on airport land use. Every option except 3 and 8 relocates the Outbound

Road to the alignment of the existing East-West Service Road, and builds a new Service Road parallel to it. This new Service Road requires the taking of some land from areas along the North Apron. Option 5 and the elevated east-west schemes (6 and 7) require more substantial takings.

Option 5 has seriously detrimental impacts on the land use potential of the Southwest Service Area. The ramp would prevent east-west circulation across the area and would require circuitous movements for any vehicles from the SW Service area to either the Inbound Road or the north-south bridge.

Options 4 and 5 require the construction of an at-grade connection between the Inbound and Outbound Roads on the alignment of the existing Ready-Car lot. This would seriously affect the usefulness of that piece of land, essentially eliminating its potential for rental car functions or other functions requiring direct access from the terminals. The parcel could be used for expansion of the Hilton Hotel.

Options 3 and 8 have an elevated roadway crossing the Ready-Car lot. This might be constructed in such a way as to have minimal interference with at-grade parking.

Each of the schemes returns some land from roadway use to potentially leasable use. Every Option except 3 and 8 moves the Outbound Road from its present location onto the alignment of the East-West Service Road. This opens up the present alignment of the Outbound Road, and the landscaped area south of it, for other uses.

The alignment of the North-South Service Road in the SW Service area varies among the options, but the amount of land taken for roadways will be small and nearly the same in every option.

Interface with other Airport Plans

Reorganization and potential re-building of the roads serving the terminals is discussed in the following section. A discussion of various options for the terminals themselves can be found in Chapter 6. All of the roadway schemes for the western end of the airport are compatible with nearly all of the terminal area improvement options.

Construction and Staging Requirements

Options 1, 2, 3, 4, 5 and 8 could be built with relatively minor disruption of airport traffic and few impacts outside the airport.

Options 6 and 7 would entail major elevated detours and complex construction staging. Traffic would be disrupted

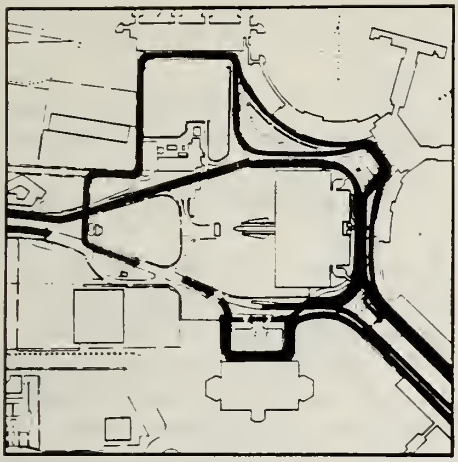


Figure 8.10

Passenger Drop-off and Pick-up circulation

■ Upper Level

■ At Grade

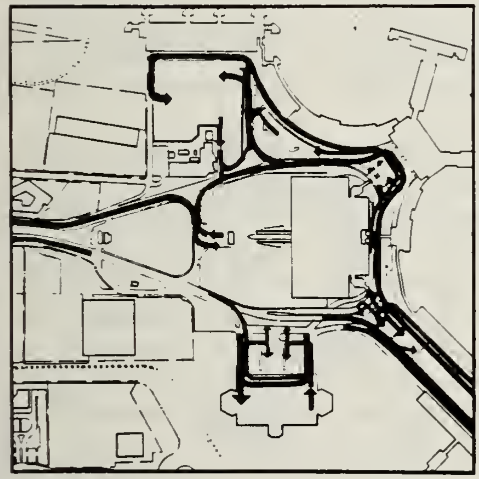


Figure 8.11

Short Term Parking Circulation

■ Upper Level

■ At Grade

for perhaps two years and costly temporary structures would be needed to maintain capacity at the highway ramps. City land would be needed for detours and Massachusetts Department of Public Works' (MDPW) concurrence would be required.

If a minor or moderate build option is chosen which moves the Outbound Road to the current alignment of the East-West Service Road, future construction of a major build option in the same alignment would be hampered. Therefore, the existing Outbound Roadway alignment should not be foreclosed until a final decision is made on a long-range roadway option.

Off-Airport Issues

A Third Harbor Tunnel would have a major impact on airport circulation as well as the number of vehicles that could reach the airport. Until it is known whether a Third Harbor Crossing will be built and what its design would be, it is difficult to choose a long range airport roadway scheme. It is possible that these questions will be resolved before interim roadway solutions become inadequate.

Cost

The estimated cost of the Options ranges from $1.1 to $40 million.

Conclusions

When the evaluations of each option are combined, most of the options suffer from a major drawback. Option 1, which addresses the need for improved east-west traffic capacity least well, emerges as the only option which does not have other major drawbacks. The serious problems which have emerged are as follows:

Option 1.	Limited improvement to east-west traffic flow.
Option 2.	Limited improvement to east-west traffic flow, 4(f) impact.
Option 3.	Impact on 4(f) land.
Option 4.	Taking and access impact on 4(f) land, impacts on Ready-Car site. Complicated Service Road intersection.
Option 5.	Inadequate circulation, severe land use impacts on SW Service area, ramp noise impact on community, impacts on Ready-Car site.
Option 6.	Some land takings on North Apron, high cost, major staging problems.

Option 7.	Some land takings on North Apron, high cost, major staging problems.
Option 8.	Incompatible with garage on Ready-Car site. Complex service road intersection in Southwest Service area.

Terminal End Roadway Options

The layout of the terminal-end roadway at Logan is basically a main loop with smaller loops leading off it to each of the terminals. This roadway system serves four primary traffic movements: 1) the drop-off and pick-up of passengers at the terminal curb, 2) access to short-term parking from the curb and to the curb from short-term parking, 3) access to long-term parking from the curb and to the curb from long-term parking, and 4) inter-terminal circulation. If all of these primary movements can be achieved directly and efficiently the roadway system will be performing well. When any of these movements requires circuitous and/or confusing movements the system is not completely satisfactory. Four diagrams illustrate the movements which are accommodated by the existing roadway (Figures 8.10-8.13). The most important shortcomings of the system are the lack of connection between the North Terminal curb and short- and long-term parking, the lack of connection between Central Garage (long-term) parking and Southwest Terminal (necessary when the in-terminal garage is full), lack of connection between Southwest Terminal and the upper level of South Terminal and a very circuitous connection between the at-grade roadway and Volpe Terminal.

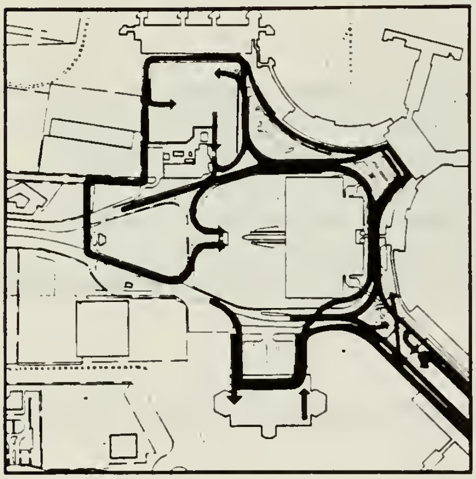


Figure 8.12
Long Term Parking Circulation

The analysis of existing conditions led to the exploration of several changes in the roadways to improve the efficiency, capacity and legibility of the roads. The two main choices which must be made are: 1) whether or not to move the ramps to the second level further from the terminals at both the inbound and the outbound points (in front of Southwest and North Terminals), and 2) whether to provide a bypass road to Volpe. A secondary design question which depends in part on the decisions made regarding the two questions noted above and in part on traffic and passenger volumes, is whether to provide a second level roadway at Volpe and remodel the terminal to make it function on two levels. Finally, one further design question was addressed; whether the main loop should go north or south of the airport power plant.

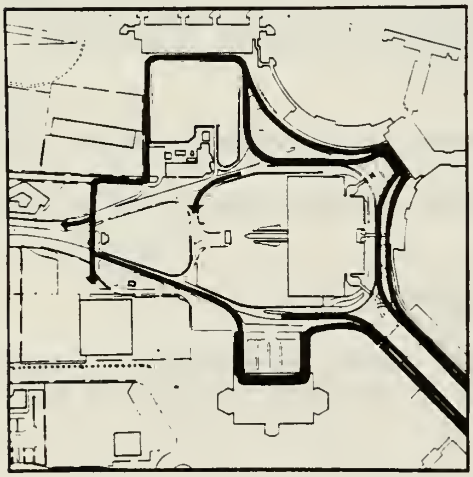


Figure 8.13
Inter-terminal Circulation

▨ Upper Level

■ At Grade

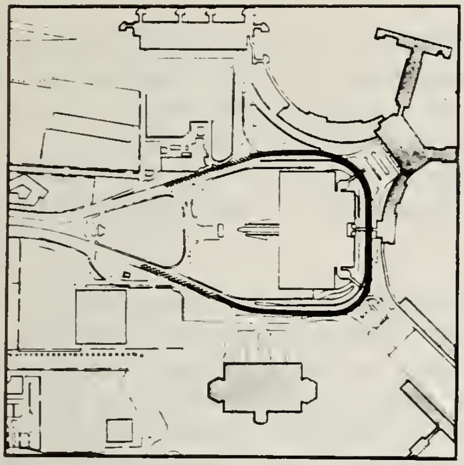


Figure 8.14

Terminal Roadway Ramp Relocation

▨ Ramp

■ Elevated Roadway

Location of Ramps

The existing ramp locations cause two serious problems to terminal area circulation. The up ramp (in front of SW Terminal) begins very close to the turn-off to SW Terminal. This proximity causes confusion among drivers who must rapidly decide among three different options; 1) turn off at the terminal, 2) go up to the departure level and 3) stay at-grade for the arrival level. If the ramp were reconstructed further west, away from the entrance to SW Terminal, the decision points could be given greater separation and therefore increase clarity for drivers.

The down ramp, in front of North Terminal, brings vehicles from the upper level curbs down to meet the at-grade roadway just east of the exit to Volpe Terminal. The ramp is located in such a way that vehicles on the at-grade road cannot exit to Volpe, instead they must exit at North Terminal and go via the North Terminal and Pier A curbs. This route is confusing and increases congestion at the North Terminal and Pier A curbs. If the down ramp were relocated west of its present alignment the clearance could be obtained for an at-grade exit to Volpe which passes under the elevated roadway.

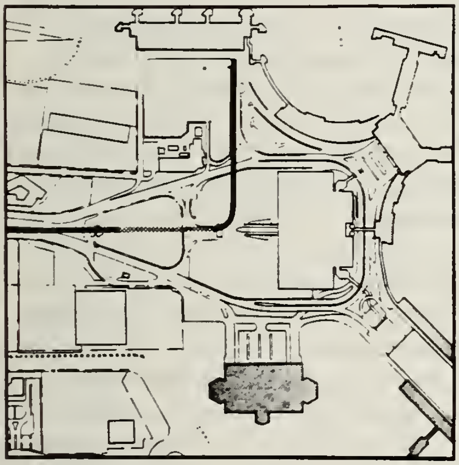


Figure 8.15

Volpe Bypass Roadway

■ At Grade Roadway

▨ Ramp

■ Elevated Roadway

Bypass to Volpe

The existing terminal roadway system is such that all traffic must use the full length of the loop - whether after going to the terminal, such as SW Terminal users, or before getting to the Terminal in the case of Volpe. Because all of the airport traffic must use the entire loop, the volumes which the road must carry are high. When different terminals have traffic peaks at the same time, the roadway must accommodate many entering and exiting movements, some of which require weaving across several lanes of traffic. The restricted area available for the roadway, and the short distance between terminals forces design solutions with less than optimal weaving and merging distances. These conditions suggested that the removal of some volume of traffic from the main loop would enhance the flow of traffic and reduce overall congestion. The only terminal which can be conveniently reached without going around the entire loop is Volpe. A second level bypass, with vehicles picking up that route without ever getting into the terminal area can be accomplished as shown in Figure 8.15.

The bypass would ramp up parallel to the Central Garage entry road and cut across the central part of the airport, crossing the main loop just west of the existing exit to Volpe. The bypass would join up with a new second level roadway serving Volpe. A second level roadway at Volpe is a necessary adjunct to the bypass, otherwise a long, circuitous, and expensive down ramp would be needed to get from the bypass to ground level.

Volpe Curb

The Volpe curb is presently inadequate during peak hours. Two possibilities exist for increasing the curb space; 1) widen the roadway in front of the terminal and build islands to accommodate vehicles wishing to pick up or discharge passengers, or 2) build a second level curb like those which exist at the other terminals. Each option has advantages and disadvantages.

Widening the road and creating channels is a relatively simple and inexpensive job. The rebuilding could be done with a minimum of disruption within a few months. The problems with this solution are that people alighting at the outer pedestrian islands would have to cross several lanes of traffic to reach the terminal curb, and that it is difficult to convince people to use an outer curb. It is probably preferable given local driving norms, that buses, limousines and shuttles be required to use island curbs, despite the inconvenience to passengers of these vehicles, for two reasons: these vehicles can be relied on to use the assigned curb space, and they would pose hazards to crossing pedestrians stepping out between buses if parked at the terminal-side curb. However, the terminal-side curb is reserved for multi-passenger vehicles at airports such as O'Hare and should not be ruled out at Logan.

The addition of a second level curb at Volpe could add the needed curb space close to the terminal. The terminal itself could be remodeled to take advantage of entries on two levels and gain some of its needed additional space in the process. A two-level curb at Volpe would also increase the consistency of the airport's layout and perhaps help to create a unified and legible image. Building a second level curb and remodeling the terminal is an expensive proposition, and one that would involve a fairly major disruption in service. One important question regarding a two-level curb at Volpe has to do with the nature of peaks in international arrivals and departures. Unlike domestic traffic, the peak hours are not evenly balanced between arrivals and departure. Rather, there is a peak arrival hour and a peak departure hour. This split in peaks means that sorting all the traffic into upper level for departure and lower level for arrival would not distribute traffic evenly between the upper and lower curbs. The need to mix the function of the two curbs and get people to use both levels has not been resolved.

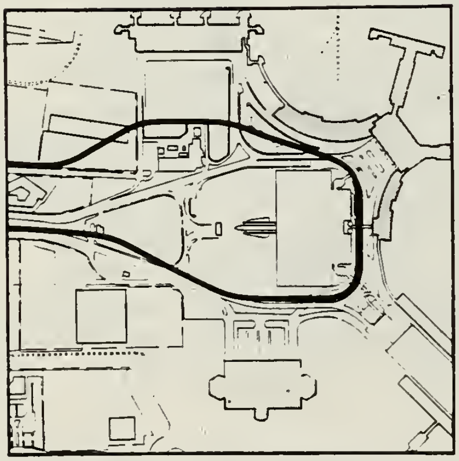


Figure 8.16

Alternative Terminal Roadway Alignment

■ Elevated Roadway

Terminal Roadway Loop Alignment

There are two possible alignments for the loop road as it heads outbound from North Terminal; south of the power plant (its existing alignment), or north of the power plant (closer to Volpe). During initial large scale design studies it appeared that there might be some geometric roadway design advantages in moving the loop north of the power station. On closer, larger scale examination, the advantages of maintaining the road in its present alignment became clear. The most important advantages are the more generous spaces which remain for circulation in front of Pier A and adjacent to the proposed new Volpe garage. In addition, maintenance of the existing alignment is less expensive than construction of a completely new roadway segment.

Coordination of Options

The coordination of the eastern and terminal-end roadway options with each other and with the terminal and parking options is discussed in Chapter 10, "Coordination of Projects."

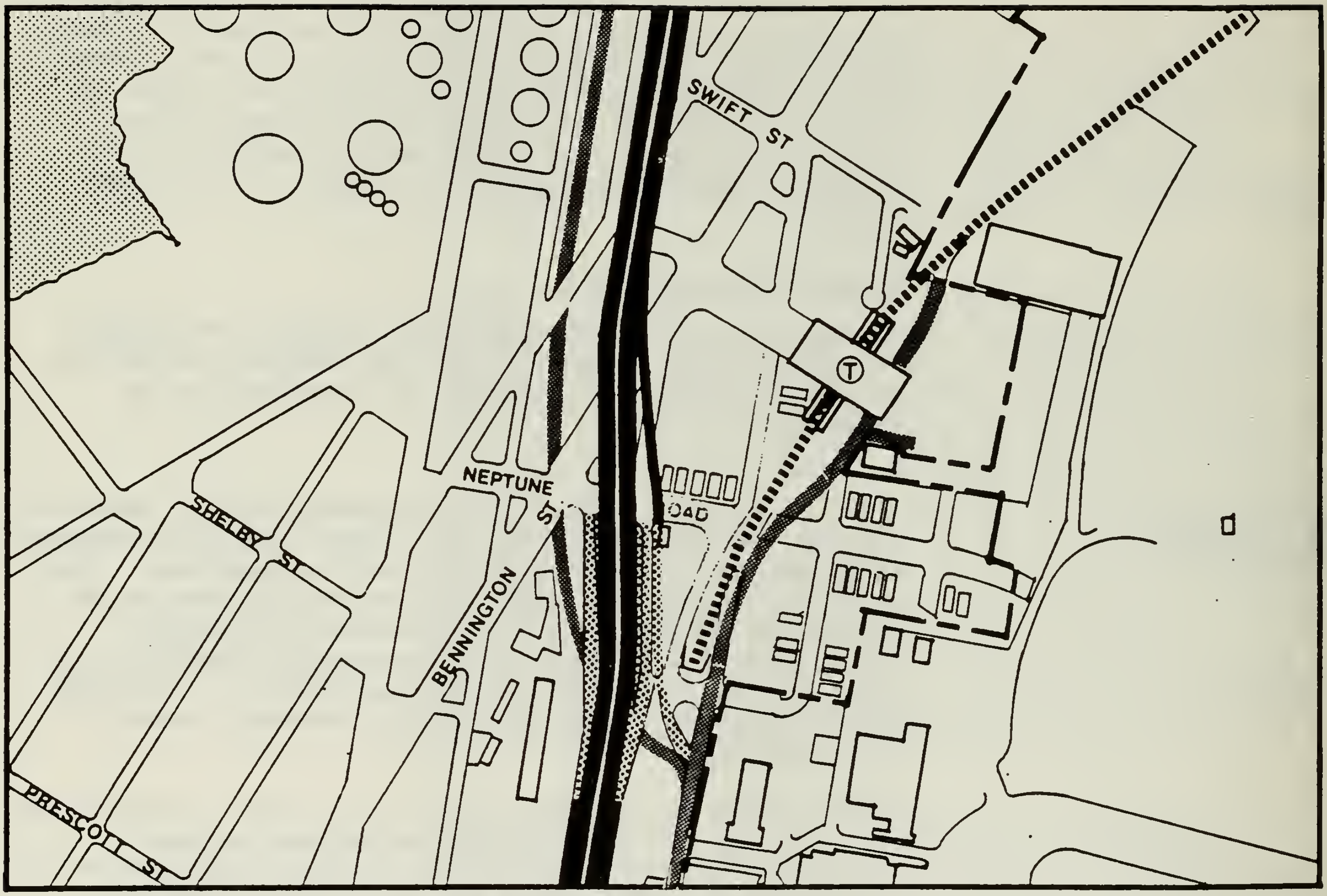
Neptune Road Interchange

The highway which people from both Boston and the northern suburbs use, C-1, has exits which bring vehicles to Neptune Road just north of the airport's north service area. The exit from the highway southbound and the entrance to the highway northbound are very inconvenient for airport traffic. These two routes require airport traffic to use local streets to get to and from the airport. This slows down traffic and causes serious environmental impacts in the community.

The provision of convenient and direct ramps to replace the existing one will benefit both the airport and the community. The two options shown have been examined at 1" = 100' scale. Both options use the abandoned railroad alignment which runs under several local streets for southbound access to the airport. A long ramp on embankment from the Route C-1 exit road to railroad grade would be constructed north of the Saratoga Street overpass; the roadway passes between the Route C-1 piers and enters the airport at grade.

The options differ primarily in their handling of the northbound highway entrance ramp. In Option 1 it runs parallel to the existing exit ramp. In Option 2,, the ramp begins at Lovell Street, crossing over the partially depressed MBTA tracks, then crosses over Bennington Street to join the highway. Both Options require the taking of at least one residence, but Option 1 may entail fewer takings presently existing houses.

It is recommended that preliminary engineering of a Neptune Road option be prepared in the near future so that a solution to this access problem can be built soon.



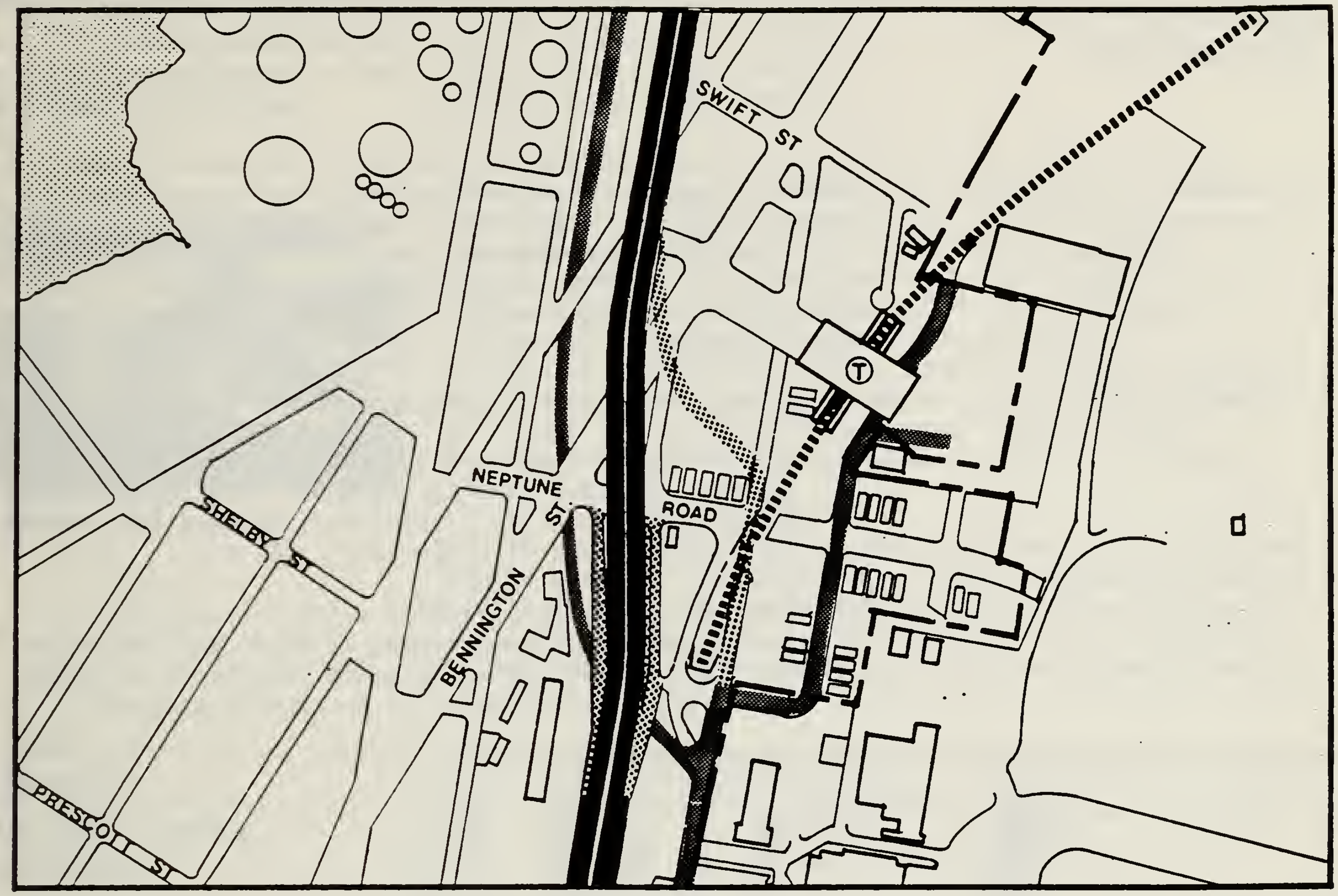
Neptune Road Interchange with Route C-1, Option 1 Figure 8.17

■ At or Below Grade Roadway

▨ Ramp

■ Elevated Roadway

0 250 500 feet 1000



Neptune Road Interchange with Route C-1, Option 2 Figure 8.18

▩ At or Below Grade Roadway

▨ Ramp

■ Elevated Roadway

0 250 500 feet 1000

People Mover and Bus Corridors

A people mover corridor and a bus corridor have been reserved in Packages 1 and 2. The corridor as shown is reserved space; no particular type of people mover system is identified.

Massport has studied people movers in the past. That analysis suggested that a corridor should be reserved but that there is not sufficient demand to justify installation of a mechanical system at this time. The maintenance of enough space for the corridor will insure that it can be installed at some future date without major rebuilding of the airport.

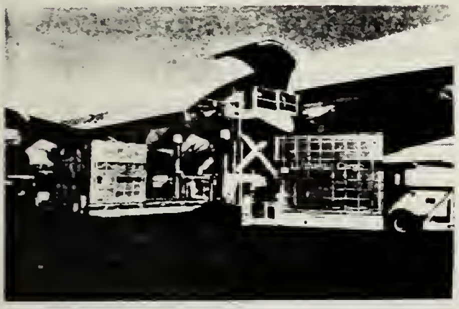
Two basic concepts are illustrated in the Packages.

1. Interconnect Volpe and Southwest Terminals with an elevated bus loop that will connect into an exclusive busway system running between all the terminals within the existing roadway alignment.

2. Provide a pedestrian walkway which connects the Central Garage with Southwest Terminal and the Volpe extension and which has adequate dimensions to allow conversion to a people mover at some later date.

Chapter 9 Cargo and Support Facilities

Air Cargo Facilities



Loading of air cargo.

Existing Conditions

All certificated carriers operating at Logan, and some commuter carriers, transport cargo in sufficient amounts to require cargo building space. This cargo is transported in two modes: in all-freight aircraft and on passenger flights, primarily in the lower deck (or "belly") cargo holds. Some carriers (e.g. American, and Northwest) operate both passenger and all-cargo flights. Approximately 27% of the cargo handled at Logan is carried by exclusive freight-only carriers. Flying Tiger, Federal and Zantop are the major all-freight carriers, with supplemental charter flights also carrying a substantial amount of cargo.

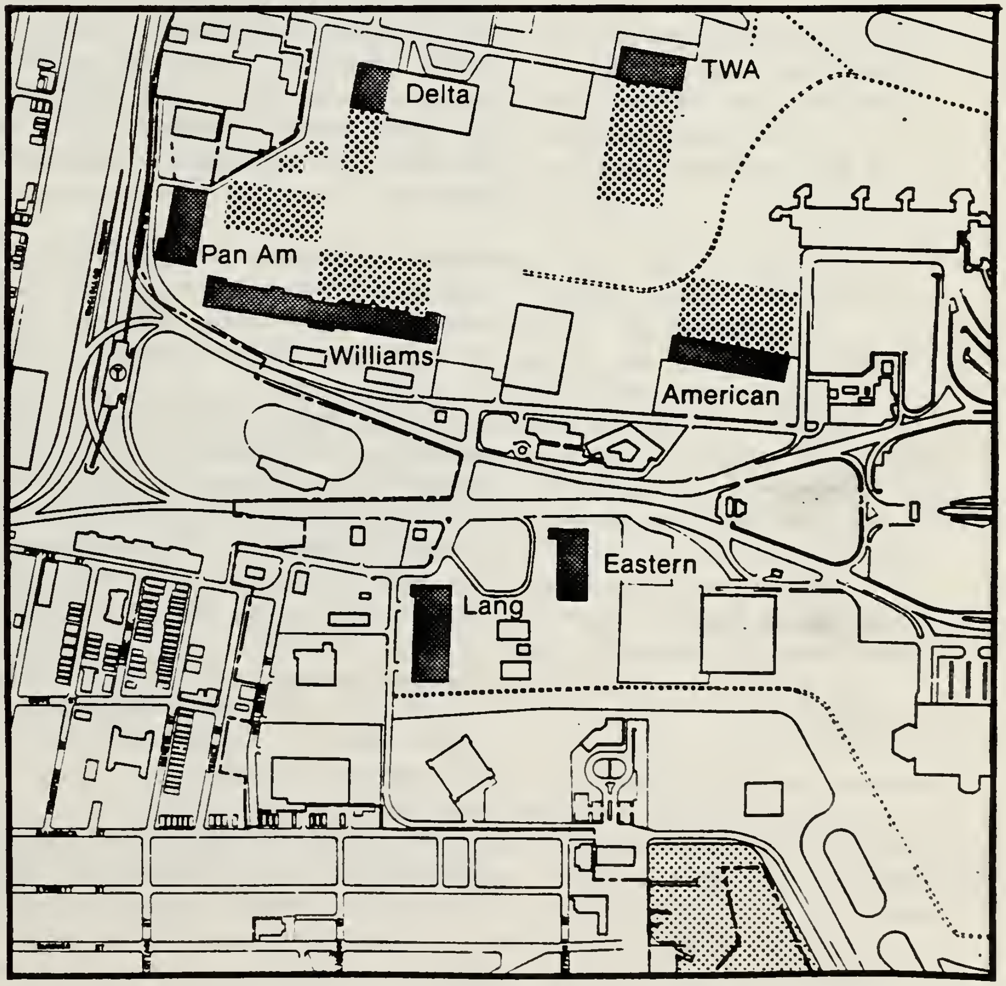
Facilities for cargo carried in freighters and on passenger flights are much the same. Both types of operation require a building with landside access on one side and airside access on another. The principal difference in facilities is that freight-only operations require an aircraft parking

Figure 9.1

Air Cargo Facility Locations

■ Building

▨ Apron



apron in addition to other facilities; this is preferably adjacent to the building but in practice may be distant from it, e.g., the present apron position used by Air France and Northwest which are wasteful of time and labor.

Sites. With some exceptions, the sites occupied by cargo carriers consist of a landside loading and parking area, a building occupying the full width of the site, and an airside area or apron on which containers, pallets and carts are staged and stored. The landside area is depressed to put truck beds at building floor level; building floors are at the apron level to allow passage of dollies and equipment.

Site depth varies greatly and is not associated with the mode of operation: some freighter operators lack an adjacent apron, while many carriers using only passenger flights have sites with aprons. Sites have from 50 to 100 feet on landside, and 50 to 525 feet on airside. Site width is a function of the scale of operation and varies in increments as small as one building bay width, 20 feet. Aprons vary considerably in size and relationship to buildings, probably as a result of chance factors such as the availability of land at the time of lease negotiations.

Buildings. The five buildings used by cargo carriers range in landside to airside depth from 105 to 175 feet. All buildings have interior columns except Delta's, which is a converted hangar. Column spacing varies from 20 by 50 feet at Williams to 50 by 75 feet at American. Dave's Motor Transportation, an air cargo trucker, has a 70 foot clear span.

Cargo buildings generally include offices at one end of the cargo handling area, often on two levels. TWA's office and employee space is typical, roughly 5,000 square feet out of a total building area of 45,000.

Problems with Existing Facilities. Existing problems include inadequate depth in truck loading areas (Williams and PanAm), excessive slope in loading areas (Lang), overhead obstacles (Williams and TWA) and inadequate airside staging area (Lang). The existing buildings appear to have more landside and airside doors than can be economically operated by the carriers' work forces.

Several cargo operators reported that columns restrict circulation, cause accidents, and restrict utilization of floor space. Column spacing is especially tight at the Williams Building.

Sites used for air cargo are acceptably located, although American's site requires a long airside trip to its passenger gates; this site will probably be directly involved in terminal expansion. The TWA site should eventually be redeveloped to improve the geometry of North Apron, which is constricted at its east end.

Future Facility Requirements

Layout for Site Planning. During Year I, it was assumed that cargo buildings should be 150 feet in depth and indefinite in width, with non-bearing party walls between users. Building space would be divisible in units as small as a single structural bay. This arrangement has been met with approval by the several cargo carriers interviewed. Building depths from 120 to 160 feet are acceptable, and in order to avoid interior columns, it may be desirable to provide clear spans up to 120 feet.

Clear height should be 30 feet, sufficient to stack 8-foot upper-deck containers three levels high . This height also allows a two-level zone of offices and employee facilities within the building shell, an arrangement that allows management offices to have clear views of the entire operation. For buildings not associated with an apron and not sited to act as a noise barrier, a lower ceiling height of 16 to 20 feet may be acceptable and would reduce construction and heating costs.

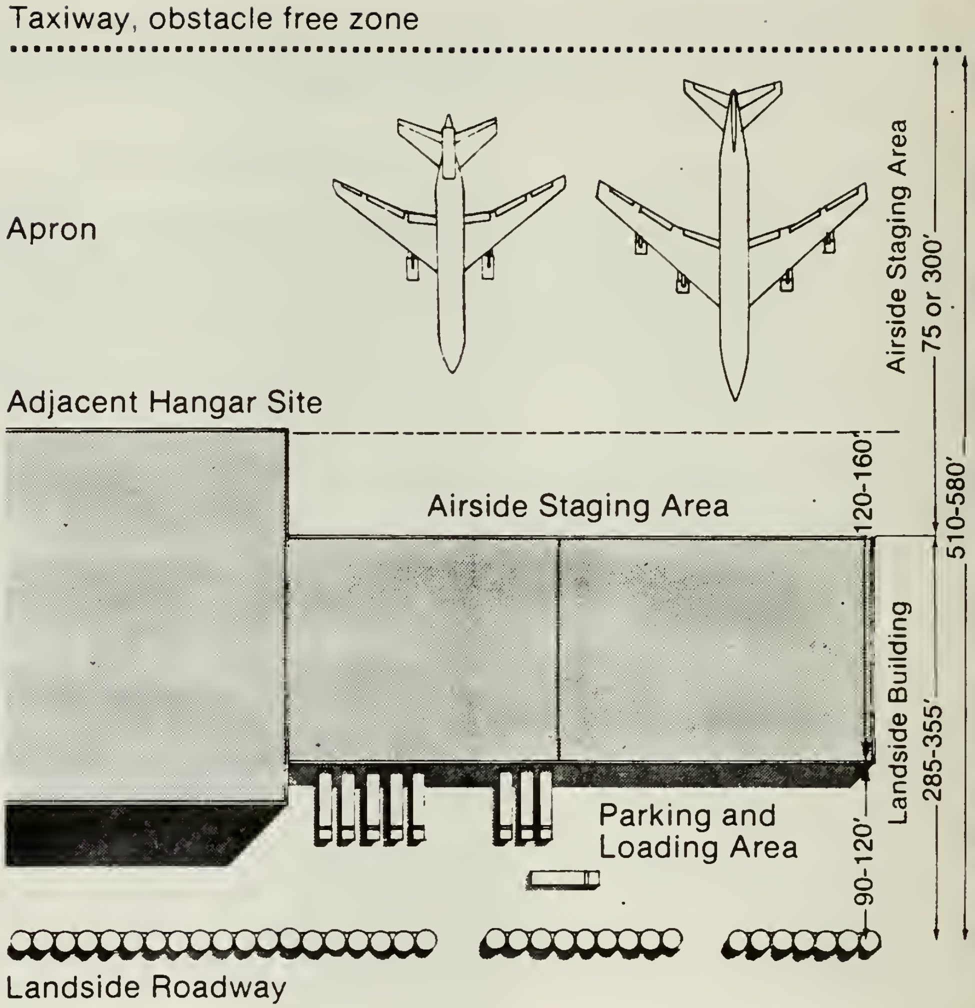
A number of building details and specifications should be determined by the specific needs of the prospective user. A landside area at least 90 feet deep should be provided for truck maneuvering and parking and to allow for acceptable gradients between the landside roadway and a depressed loading area (See Figure 9.2).

Airside staging area for buildings that lack an apron should be at least 75 feet deep. Apron depth, measured from the building face to the edge of the taxiway obstacle-free area should be at least 300 feet for future model B-747 or stretch DC-10 aircraft, or for apron arrangements that require an unusual amount of outdoor staging, a 250-foot depth is permissible if site limitations necessitate. Apron width can be divided according to the wingspan of the largest aircraft to be accommodated; a B-747-200 requires 225 feet of apron width for taxi-in/push out maneuvering perpendicular to the building. The apron area just described allows room for staging a full outbound load of cargo forward of the wings, e.g., 36 pallets and 30 lower deck containers for a B-747-200.

A sample calculation was done for a hypothetical apron used for one 80% loaded B-747 arrival daily. This volume of cargo would require perhaps 25,000 square feet of building area, or roughly one apron width. More active carriers may require additional apron and building modules or additional remote cargo building space. The relationship between building area and apron is highly variable and it appears

Figure 9.2

Air Cargo Site Layout



difficult to increase the intensity of apron utilization without maintaining more control over carriers' facility locations than is possible under the usual long-term ground lease. There should be no problem providing sufficient cargo apron and building facilities in the near- to mid-term future, but some reshuffling of carrier facilities may eventually be necessary.

Intensity of Use. The utilization of air cargo facilities by carriers was analyzed during Year One. That analysis, documented in the Year One Report and Appendix, concluded that building area should be projected by the formula 5000 square feet/carrier + 1.2 x total annual tons carried. A typical carrier handling 10,000 tons of cargo per year would then require 17,000 square feet of cargo handling and office area. This allocation is generous and allows for expansion within leased space. By comparison, in 1979, Flying Tiger used its leased space at an intensity of 0.85 square feet per annual ton.

Future Building Space Requirement. The forecast for air cargo for the year 2000 is 473,000 annual tons. This is 2.4 times the 1979 cargo volume, 199,626 tons. Assuming that there are 30 carriers operating at Logan by the year 2000, an increase of 7 carriers, the formula described above predicts the need for 720,000 square feet of building area.

Much of the existing 300,000 square feet of cargo building area occupied by carriers may be displaced by redevelopment of the North Apron area and improvement of the roadways serving the terminals and BIF; by the year 2000 as little as 30,000 square feet of this space may remain and be occupied by carriers, as opposed to forwarders. Thus, 690,000 square feet of new building construction may be necessary in the next twenty years. If arranged in buildings 120 feet deep, the 690,000 square feet of building would occupy 5750 linear feet of frontage. The current BIF site plan would accommodate 380,000 square feet.

Future Apron Requirements. There are presently eight freighter aprons in use at Logan; 37% of the cargo and mail carried in 1978 (152,000 tons) was loaded or unloaded on these aprons. All-cargo carriers presently account for 27% of the cargo carried to and from Logan; the remaining cargo is carried on passenger planes or on freighters that are operated by airlines which also carry passengers, although some, such as Air France do not presently use Boston as a gateway.

The proportion of cargo carried by freighters is predicted by many analysts to decline in the future as wide-body passenger aircraft, with large lower deck cargo capacity, become predominent in the airline fleets. An analysis of the forecast January operations in the year 2000 and the passenger fleet assumed in the MPA projections reveals that even at a 75% passenger load factor, there would be a cargo capacity in passenger aircraft of 264,000 tons in that month. Assuming that the cargo load factor is 20% and that cargo is carried only 23 days per month, the January utilized cargo capacity would be 39,000 tons. This should be compared to the January 2000 forecast of cargo and mail, 44,000 tons. One may conclude that on the basis of lift capacity alone, freighters might be reduced to approximately 10% of the annual tonnage carried.

Lift capacity is not the sole consideration, however. In 1981, American Airlines made arrangements to purchase new freighter aircraft, despite overall excess capacity on its scheduled passenger flights, because it lacked sufficient capacity to certain markets at critical hours. Even if the cargo capacity on passenger aircraft is distributed to the proper cargo market destinations, the all-freight carriers, Flying Tiger, Federal Express, Evergreen, and others will attempt to maintain their market share, which is currently 27%. Bilateral agreements may leave some carriers with no alternative to freighters for service between Boston and some European cities. In addition, certain types of hazardous cargo and large units of cargo can be shipped only by freighter. Itinerant and commuter cargo carriers will also require some apron use. Assuming that all freight operators maintain a market share and that two aprons should be reserved for shared use, a minimum of six aprons would be required. Assuming that all carriers operating freighters continue to do so could lead to requirements as high as 16 aprons.

Freight Forwarders, Agents and Truckers Serving Logan Airport

Existing Facilities

Freight forwarders, agents and truckers are segments of the air freight industry whose customers are primarily small volume shippers, and shippers who use air freight infrequently or to reach non-major destinations. Forwarders are intermediate shippers who combine customer shipments under a single airbill on which the forwarder is identified as the shipper; freight is shipped on air carrier or leased aircraft. In Year One, it was estimated that 55% of the air cargo shipped through Logan is forwarded. Forwarders often, but not always, handle the freight themselves; some rely entirely on an air freight truckers for ground transportation and consolidation of several small shipments into a larger one; in either case it is the writing of a carrier's airbill that distinguishes a forwarder. Air freight truckers move cargo among carriers, forwarders and shippers. Air freight agents and customs brokers arrange for shipment and paperwork with carriers and forwarders; as such they require only office facilities and need not be located near the airport. Many agents have downtown offices.

The facilities surveyed comprise a total of 440,000 square feet in the general vicinity of the airport, 300,000 of it off-airport. The buildings vary considerably in size and suitability for air freight handling. The most common pattern among facilities designed for this purpose is a building with dock-height floors, 12 to 16 foot clear height, loading on one side only, a depth of 50 to 100 feet, and one-story office space running the depth of the building at one side of the freight handling space.

There are approximately 140,000 square feet of building space at Logan Airport occupied by forwarders, agents, and truckers. Of this amount, 48,000 square feet are office space, nearly half of it in the Delta office building, attached to the Delta hangar. The quality of this forwarder space varies from fair to very good; cargo handling space for forwarders is mostly located in buildings also used by carriers. Problems with the existing space are primarily due to inadequate truck maneuvering areas at the Pan Am and Williams buildings and at the north end of the Lang Building.

Other space is located in several areas off-airport. Robie Airport Park contains 50,000 square feet of poor to good building space occupied by forwarders and truckers. Principal problems are congested loading areas and, in some buildings, poor office space. Buildings are estimated to be 20 to 60 years old.

There are approximately 84,000 square feet of poor to fair quality forwarder and trucker-occupied building space located in residential areas of East Boston at several locations: Maverick, Orleans, Bremen and Addison Streets, Pier 1 and around Day Square. The poor loading facilities at these buildings require truck maneuvering on the street and clearly exacerbate the impacts which trucks at these buildings have on neighboring residences.

Along Route C-1, in East Boston and Revere, there are approximately 120,000 square feet of fair to very good space occupied by air freight forwarders and truckers. The buildings are estimated to range from two to 20 years old. Loading areas are less congested at many of these buildings than at some located at the airport. However, their distance from the airport requires relatively long driving times to and from the carriers' cargo terminals, especially during periods of congestion caused by commuting and race track traffic.

An additional 27,000 square feet of forwarder and trucker space are located at truck terminals on Eastern Avenue in Chelsea and on Main Street in Winthrop. Thirteen agents and brokers occupy an estimated 20,000 square feet of office space on State, Milk and Broad Streets downtown. Other forwarders and truckers who handle some air freight as well as ocean, rail and over-the-road shipping are located in South Boston and other locations as far from the airport as Reading, Braintree and Roxbury.

Approximately a fourth of the firms listed in the Yellow Pages under "Air Cargo" or in the 1978 Massport "Quick Caller" guide do not have separate facilities of their own; most of these listings represent multiple names or business arrangements whereby one firm handles all the business of another; some firms have simply gone out of business since being listed.

Impacts of Off-Airport Forwarding and Trucking

Air cargo shipping is by nature an evening and night-time activity, and this characteristic greatly increases the potential for disturbance of residential areas by air freight trucks. Insufficient loading and truck storage areas exacerbate this problem and in some instances (e.g., Reliable Trucking near Day Square) trucks are parked on-street during daytime hours.

The poor connection between Neptune Road and Route C-1 north of the airport forces trucks entering there to use Chelsea Street and those leaving to use Bennington, Swift and Chaucer Streets to connect with Route C-1. This substantially increases noise and air pollution impacts on the residences located on or near these streets. An improved connection here or an alternate access point to the airport would mitigate these impacts (See Chapter 8).

Relocation of air cargo facilities from residential areas is a Massport policy which is unfortunately difficult to accomplish. A first step is to make all air cargo facilities non-conforming by amending the Boston zoning map; rezoning is the city's responsibility, but Massport's cooperation would be helpful in accomplishing it. However, zoning does not have the power to force non-conforming activities to cease; it merely provides that such uses cannot resume in a building that has been vacant for more than a year. The objective of the owners of such property is clearly to keep it rented, so the relocation of an air freight forwarder may simply result in a new tenant occupying the building for a similar activity.

A second obstacle to removing air freight handling from the community is the very low level of rents paid for space in the community. During Year One, a survey was made of rents paid for this type of space; in 1979, they ranged from $1.60 to $5.00 per square foot, plus taxes of $0.75 to $0.90 per square foot and utilities. Small forwarders and truckers paying $2 to $3 per foot in the community clearly could not afford new space constructed on-airport, although some might afford subleased space in the older cargo buildings.

A strategy that may offer some progress over a period of years is to attempt to attract the larger forwarders to the airport from locations along Route C-1 or in Robie Airport Park; smaller firms in residential areas might then filter up to the appropriate off-airport locations. The end result of these moves will be beneficial only if the owner of the buiding in the residential area can be induced to replace the departed tenant with one in a different business whose activities are less objectionable. This will require persistence and cooperation between Massport, the city and the community over a period of years. The root of the problem of off-airport freight facilities is the presence of industrial buildings on residential streets; there is no simple solution.

Future Facility Requirements

Layout for Site Planning. Nineteen forwarders and truckers responded to a Massport questionnaire on their facilities needs. Their responses were generally positive regarding the building and site layout proposed in the questionnaire. This layout calls for an 80-foot-deep, one-sided building with interior columns, a 25-foot clear height, and one-or two-story interior-facing office space. A truck court with some auto parking would occupy an area 90 to 120 feet deep in front of the building. Forwarders who plan to lease aircraft or to operate with direct airside transfer of cargo are becoming increasingly important in terms of the volume of cargo they handle; these firms should be accommodated in buildings designed for carriers which have loading doors on two sides. However, one-side loading buildings remain best for many firms.

Aggregate Space Requirement. For planning purposes, an intensity of 1.5 to 2 square feet per annual ton should be assumed for forwarders.

The baseline cargo forecast for the year 2000 is 473,000 annual tons of cargo. Assuming that 65% is handled at a forwarder's or trucker's facility at an intensity of 1.5 square feet per annual ton, a total of 460,000 square feet of building would be required. At 2 square feet per ton, 615,000 square feet would be required. Roughly 25% of this aggregate amount of space would be used for offices.

One may speculate that slightly more than half of the existing space (440,000 s.f. on and off-airport) may remain in use at least until the year 2000; the rest would be vacated for environmental reasons, displaced by other uses, or redeveloped. The requirement for new construction on new or existing sites would range from 230,000 to 390,000 square feet. This 20-year "forecast" can be compared with the requests for additional space in the questionnaires returned to Massport. Assuming that suitable terms can be arranged (which is not certain) existing forwarding and trucking firms might look for 168,500 square feet of building space at Logan within the next three years. Sites for this amount of building would occupy 11 to 19 acres, excluding roadways.

The lower, and possibly the higher estimate could be entirely accommodated at appropriate industrial sites off-airport; it is unlikely that all of the future space could be accommodated on-airport. The amount of facilities to be provided on-airport should be determined by both cost feasibility and environmental considerations.

Aircraft Maintenance Hangars

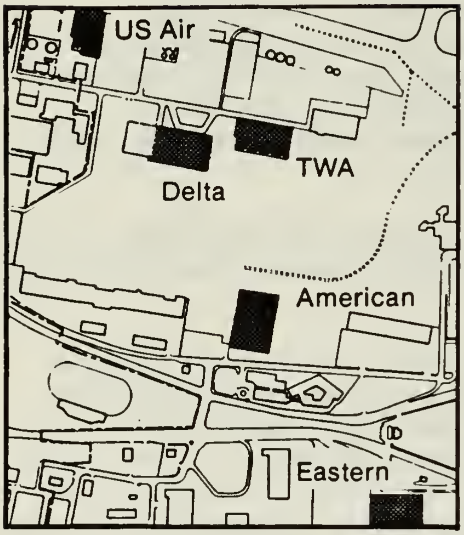


Figure 9.3

Airline Maintenance Hangar Locations

Existing Facilities

The existing hangars at Logan are in usable condition although most of them do not accommodate wide body aircraft owing to insufficient door height. The hangars are valuable to their users because their capital amortization costs are low compared to those of new facilities; however, aircraft maintenance is not an essential activity at Logan. Hangars should be preserved as long as airport-wide staging considerations allow, but they need not be replaced if taken for higher priority uses. However, one or two shared maintenance positions for unscheduled repairs by all carriers would be desirable.

Aircraft maintenance hangars are used by five airlines at Logan: American, Delta, TWA, USAir, and Eastern. Butler Aviation, a fixed base operator, also occupies a hangar. These facilities are identified in Figure 9.3. Some major carriers have no hangar, although some do have maintenance stores and equipment in other types of buildings at Logan; these carriers include United, Northwest, Braniff and the international carriers.

All hangar facilities contain a large clear-span area to accommodate one or more aircraft plus an area occupied by store rooms, shops, offices and employee facilities. The hangars used by carriers at Logan range in capacity from two to four aircraft positions.

Hangar depth is adequate for three-engine wide-body aircraft at the American, Eastern, TWA, Delta (DC-10 only) and USAir hangars. The Eastern hangar, and possibly the TWA and USAir hangars, cannot accommodate A-300's because that aircraft's engine placement interferes with the use of the building's nose dock. Only the American hangar would have adequate depth for a 747, if the door were modified to accept that aircraft's 64 foot tail height. All hangars have adequate width to accommodate the wingspan of planes which they have sufficient depth to accommodate.

Apart from the dimensional limitations discussed above, there do not appear to be any significant problems in the hangar sites and buildings from the point of view of the carriers that use them. Eastern plans to modify its hangar to accommodate the A-300.

The use of existing hangars varies considerably. Three carriers, TWA, Delta, and USAir do relatively light servicing of aircraft in their hangars: tire and landing gear work, cleaning, de-icing, tail washes, and unscheduled engine changes. Much of this work and routine line checks can be done at the terminal apron except when bad weather interferes.

American and Eastern service a larger number of aircraft at heavier levels of service than the other carriers. This includes major service checks of 707, 727, and DC-10 aircraft by American, including routine engine and component changes and intensive interior cleaning. Eastern does major service checks including engine and component changes, intensive cleaning, and airframe work on DC-9, 727, and L-1011 aircraft.

Future Facility Requirements

The need for additional hangar facilties at Logan Airport is very doubtful. Generally, airlines prefer to invest at hangar facilities at airports which are hubs in their route structure; therefore hangar facility needs are closely tied to other types of facility needs. There is no immediate candidate for this type of investment at Logan. However, there may be a need in the future for replacement of an existing hangar, such as American's, whose site may be required for higher priority land uses. Particular hangars may become less used when an airline's predominantly used aircraft become too large for them, or they may need to be taken by Massport if they occupy sites required for higher priority land uses such as passenger or cargo terminals. The possibility also exists that smaller carriers may find it desirable in the future to build a hangar for joint use.

Hangar Layout for Site Planning. Should it become necessary to plan for either new or replacement hangar needs, the following layout is recommended. This layout would accommodate two aircraft the size of the stretch DC-10-63, currently being designed; the layout would also accommodate future L-1011, B-767, and A-300 aircraft, as well as smaller standard bodies (see Figure 9.4). A slightly higher roof and wider building with nose docks extending its usable depth would allow B-747-200 aircraft to be accommodated within the building envelope.

The overall building dimension is 235 feet deep by 370 feet wide, with a 60 to 70 foot clear height at the apron side. The hangar could share party walls with adjacent hangar or cargo buildings; it could be made wider to accommodate three or more aircraft without altering its compatibility with the overall site plan: roadway-to-taxiway depth rather than the width of the site is the critical dimension for site planning.

The depth of the site would include that of the building described above, plus 50 to 90 feet on landside for parking and truck loading, and 250 feet on airside for apron. The site depth assumed for hangars is compatible with that used for the layout of freighter facilities. These uses could be sited adjacent to one another without disturbing taxiway and roadway alignments.

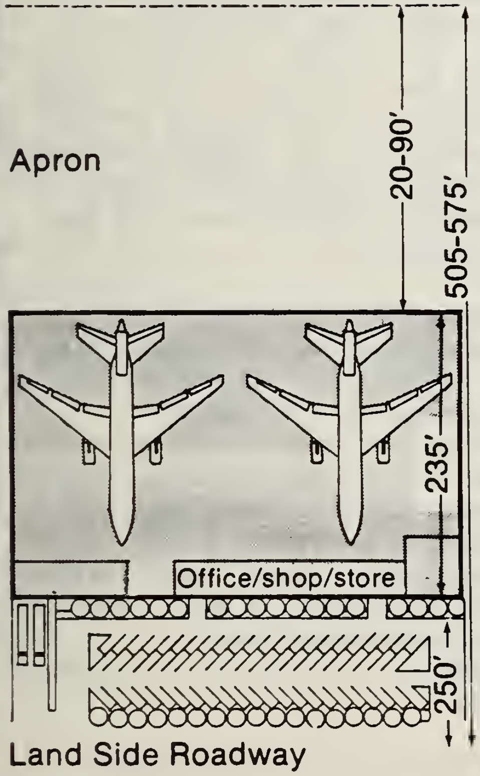


Figure 9.4
Hangar Site and Building Layout

A 50-foot deep landside parking area and loading area for the hangar allows for back-in loading by tractor-trailer trucks delivering parts. The loading area can alternatively be reduced to as little as 20 feet, in which case truck loading would be done with the truck parallel to the building or at a dock recessed within the building. Landside depth is partly a matter of the amount of employee parking that should be provided on site; this is a question of policy.

The 235-foot hangar building assumed in this site layout would be divided into a 205-foot clear span area for aircraft plus a 30-foot deep zone of offices, shops, locker and lunch room, and other facilities. Gaps in this area can be provided to create a nose dock or tow tractor pass-through, and at the corner of the hangar deeper rooms can be provided for ground service equipment maintenance and paint sheds. (See Figure 9.4). Access to the GSE shop would be through the hangar from airside.

Food Preparation Facilities

Food preparation facility at Logan.

Existing Facilities

In-flight meals for the carriers serving Logan are provided by four facilities: Marriott, Air La Carte, Sky Chefs (owned by American Airlines) and the United Airlines Flight Kitchen.

Firms that prepare in-flight meals require building space for food storage and preparation, truck docks for both vendor delivery trucks and their own trucks carrying prepared meals to the terminal apron and returning with refuse.

An ideal site would be located near the terminals and would have direct airside access on one side of the building and separate landside access on another. The facilities presently used at Logan fall short of this ideal and vary considerably in their workability.

Site. Food preparation facilities are arranged with loading areas on one side of the building (Marriott, Air La Carte) or both sides (United, Sky Chefs). There are generally one or two loading positions for vendor deliveries of food products, supplies and pre-prepared meal components. Several loading positions are usually reserved for loading and unloading trucks bound to and from the terminal apron. One or two loading positions are permanently occupied by trash dumpers. Some truck parking area in addition to the loading positions is also needed. Parking on-site is provided for customers at all facilities, and employee parking is also provided except at Air La Carte.

Site dimensions are set primarily by adding necessary loading and truck maneuvering areas to the building dimensions and providing additional site area for truck and automobile parking.

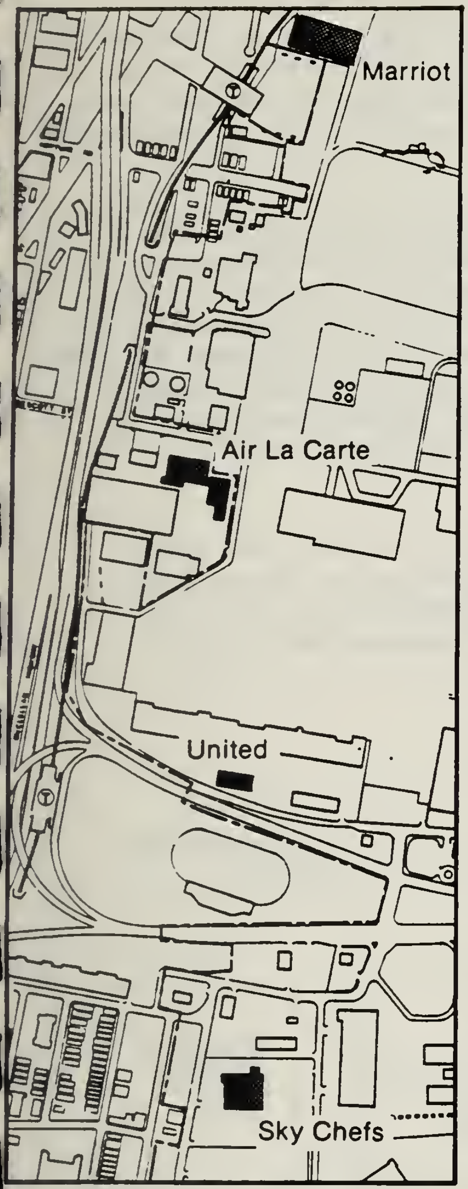


Figure 9.5

Food Preparation Facility Locations

Building. The buildings occupied by Sky Chefs and Marriott were designed for food preparation; those occupied by Air La Carte and United were adapted from warehouse use. Sky Chefs and United utilize two floors, while Marriott and Air La Carte use one. All buildings are steel framed with masonary walls and interior columns. All have tiled concrete floors and interior finish.

The loading area at Air La Carte and at the vendor delivery side of United are poorly designed. ALC's loading area slopes at an unacceptably steep grade, and maneuvering room is inadequate at United. Parking for employees is not available at Air La Carte, many of whose employees walk to work or ride the MBTA. Marriott's site has access only on airside, including vendor deliveries and employee parking, which does not disturb its operation but does pose a potential airport security problem.

The United and Air La Carte buildings are too narrow (60 and 90 feet, respectively) in their shortest dimension to function properly and are insufficient in area; problems will increase next year at United when B-767's and more DC-10's with modular lower deck galleys are assigned to Logan. Sky Chef's two level design is quite inefficient in utilizing space, since food preparation cannot be equally split between two levels; congestion and delays are caused by the elevators. Similar problems occur with second level storage at United. The Marriott building should have somewhat more storage area than at present but works successfully in most other respects.

Future Facility Requirements

Building Area. Survey of the facilities and interviews with their managers revealed that space is fully used at the United, Marriott and Air La Carte buildings, probably beyond reasonable efficiency at United and Air La Carte. United intends to enlarge its building to provide additional storage. Marriott recently leased space in Jeffries Point to supplement its storage area. Sky Chefs is less crowded in its building.

The amount of space required per unit of output also depends on the extent to which pre-prepared meal components are used instead of foods prepared at the facility: pre-prepared foods require only storage and set-up facilities. Use of these components is almost total at Air La Carte; other firms use them to varying extents. Operations involving lower deck galley modules, used at United and Sky Chefs, require additional space for storage of the modules.

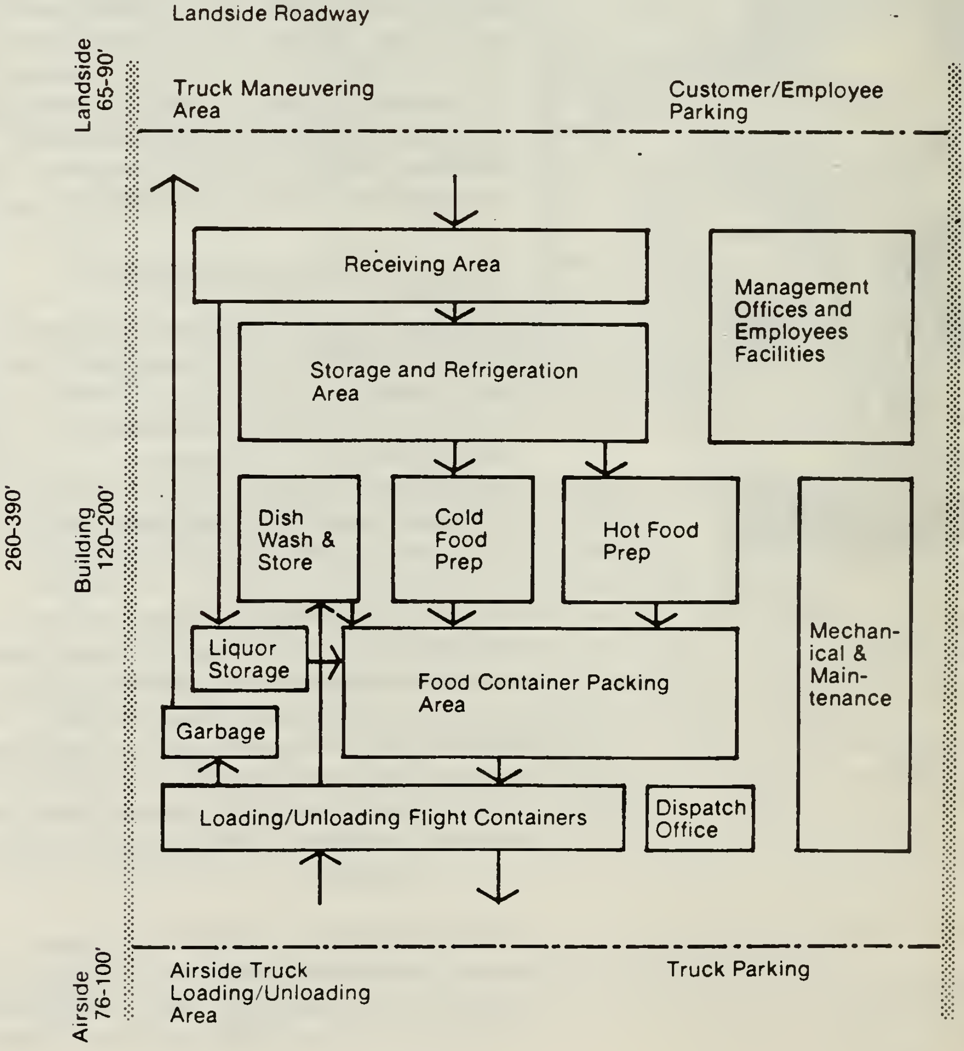
It is recommended that 10 square feet per meal prepared daily should be used for planning purposes. However, it should be recognized that any radical shift to reduced food service by the airlines might reduce the per meal space requirement by perhaps 40%, since approximately that proportion of present food preparation space is occupied by preparation and dish cleanup associated with full menus, as opposed to set-up, storage and other activities that would continue to be required if there were a shift to sandwiches and disposable packaging.

For planning purposes one loading position should be provided for each four to five daily two-way truck trips. Approximately 2 to 3 vendor trips and 15 caterer trips should be assumed for each 1000 daily meals prepared. At design levels of space utilization (10 square feet per 1000 meals per day), the requirements are one vendor truck position for each 13,000 to 25,000 square feet, and one caterer truck position for each 3000 square feet of building area.

Building Layout for Site Planning. An idealized food preparation building and site organization is shown in Figure 9.6. There should be at least 65 feet of truck maneuvering area on landside and preferably 90 feet;

Figure 9.6

Food Preparation Site and Building Layout


Landside Roadway
Landside 65-90'
Truck Maneuvering Area
Customer/Employee Parking
Receiving Area
Storage and Refrigeration Area
Management Offices and Employees Facilities
260-390'
Building 120-200'
Dish Wash & Store
Cold Food Prep
Hot Food Prep
Mechan-ical & Main-tenance
Liquor Storage
Food Container Packing Area
Garbage
Loading/Unloading Flight Containers
Dispatch Office
Airside 76-100'
Airside Truck Loading/Unloading Area
Truck Parking

airside loading areas should have at least 50 feet and preferably 65 feet of maneuvering area. Airside truck parking spaces should be approximately equal to loading positions.

This type of site layout is consistent with a building which has party walls on two sides. Landside-to-airside building depth can vary somewhat because the functional areas within the building can be arranged within a range of envelopes. The maximum depth should not exceed 200 feet because of the need to maintain sufficient width for airside loading positions. A minimum efficient building dimension is probably 100 feet; this allows for adequate circulation among functional areas of workable size. Marriott's 140-foot depth appears to work very well despite the building's high intensity of use.

Buildings should have one story, except that employee and office facilities can be located on a second level if desired. This would increase flexibility on the operating level and provide opportunities for natural lighting in the employee and office area.

The building and site layout described above can range in depth from 270 feet to 390 feet between landside and airside roadways. Site and building depths are compatible with requirements for non-freighter cargo facilities, with which party walls can be shared.

Space Requirements. The number of meals prepared per departing passenger is a function of the length of the flight, the time of day, and the policies of the airline. The following estimate assumes that food will continue to be provided at the same level as today for similar flights and that future food production will utilize facilities at present intensities of use. These estimates may thus overestimate the total need for food preparation space if fewer meals are required or space utilization is intensified.

Presently, food service on domestic and transborder flights from Boston varies from a beverage only on flights shorter than one and one-half hours to a full meal plus a snack (counted as half a meal) on some transcontinental flights. Present daily average levels of meals per passenger are thought to be representative for domestic and transborder flights. This level is estimated to be 0.26 meals per passenger (in and out) for an average day in the peak month of August.

Passengers on direct intercontinental flights are usually served two meals, or one meal per day total passenger (in and out).

The forecast assumptions provided by Massport for the year 2000 call for 84,000 domestic and transborder passengers and 31,000 other international passengers on the average day of the peak month. These passengers would require 53,000 meals: (84,000 x .26) + (31,000 x 1.0) . For comparison, in 1979, there were 15,000 meals required on the average day of the peak month. This increase represents more than a tripling of present food service volumes, owing in part to the forecast increased share of international passengers.

The existing Marriott and Sky Chefs facilities are of modern design and should be usable for the next 20 years. The United Flight Kitchen is less suitable, and the building occupied by Air La Carte is unsuited to food preparation. The United and Air La Carte buildings are assumed to be removed by the year 2000. The Marriott and Sky Chefs buildings would provide a total of 104,000 square feet for meeting future demands.

At the recommended 10 square feet of building per meal, 530,000 square feet of building would be required for year 2000 demands. After accounting for the 104,000 square feet of existing space, a balance of 430,000 square feet of new building would be required. Changes in airline meal policies might reduce this space requirement.

General Aviation and Ground Service Facilities

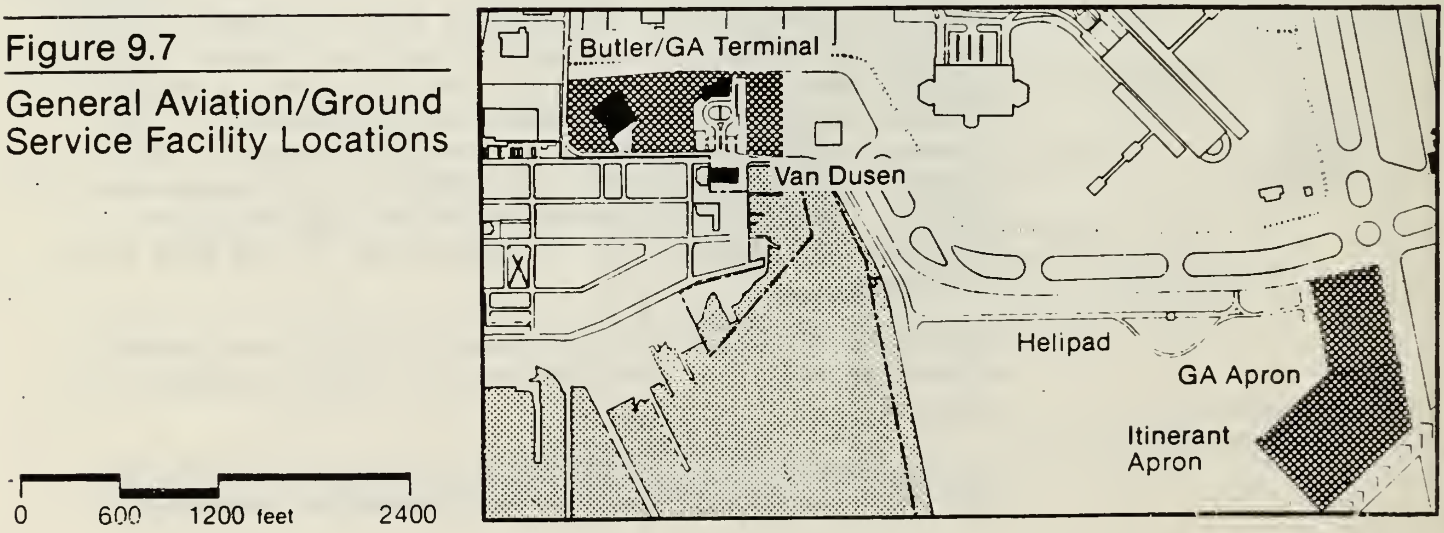
Ground Services for General Aviation (G/A) are provided by two fixed base operators (FBO's), Butler Aviation, Inc., and the Air Associations division of Van Deusen, Inc. These fixed base operators also provide a variety of services not related to general aviation; two other ground service companies, Airways, Inc., and Airfreight Service Corp., do similar work.

Existing Facilities

Figure 9.7 identifies the locations of the fixed base operators, service companies, and Massport G/A facilities. Major areas are the Bravo Apron (500,000 square feet),

Figure 9.7

General Aviation/Ground Service Facility Locations



Butler Aviation hangar.

Edson Building and ramp (340,000 square feet), Butler base area (628,000 square feet) and helipad clear area (110,000 square feet). These and other smaller facilities total 1.7 million square feet.

Aircraft ramps occupy the largest site area of the types of G/A land use. Large areas are also occupied by storage of fuel trucks and other equipment, by fuel farms, and by parking for employees and G/A users. Buildings containing terminal and office space occupy relatively little site area.

Future Facility Requirements

The Massport aviation forecasts assume that Logan's general aviation operations will remain constant at approximately 50,000 operations per year. Facilities requirements are therefore not expected to increase. The mix of operations is expected to shift to one predominanted by corporate jets. Given the presently sparse utilization of parking apron around the general aviation terminal, a total of 400,000 square feet of G/A apron represents a generous estimate of present aircraft parking area, and this should suffice for the next 20 years; this area does not include public use apron for large itinerant charter aircraft which now occupy the recent extension of Bravo Apron. The apron area provided in the BIF Environmental Impact Report appears to be adequate in size and location to handle future needs.

In addition to parking apron, site area for a general aviation terminal (including lobby, Flight Service Station, FBO-operated lounges, and food service) and G/A-related offices should be provided adjacent to the parking apron. The BIF site plan provides for these needs.

Car Rental Facilites

Existing Conditions

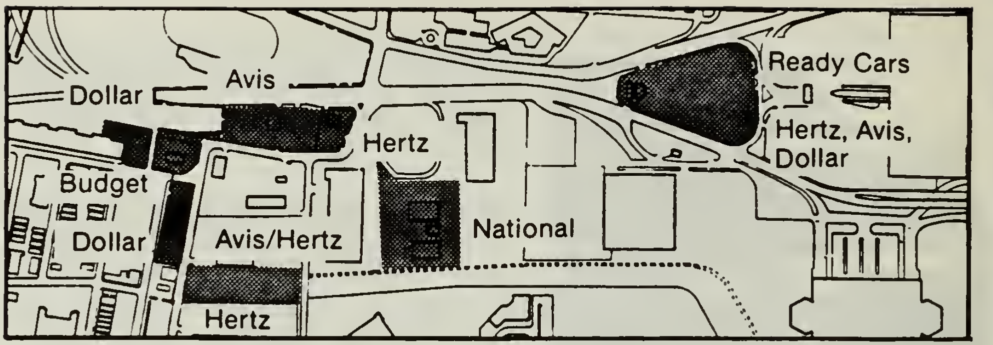
Car rental facilities serving Logan are located both on- and off-airport, with the five on-airport firms doing the great majority of airport business. The locations of the airport car rental facilities are shown in Figure 9.8.

Each car rental firm operates a check-in and office facility located in the Southwest Service area, with fueling and washing facilities and auto storage areas adjacent to it. Hertz, Avis, and Dollar lease ready-car spaces in the central parking area. Each firm also operates rental desks at each passenger terminal. These facilities are connected by firm-operated fleets of shuttle buses and vans which take customers to and from their cars.

Competition in the rental car business is based on service, convenience, and visibility. Shuttle headways are aimed at the first two of these factors, while site location affects the last two.

Figure 9.8

Car Rental Facility Locations



Site size and layout also affect the firm's cost and ease of operation. Firms prefer consolidated facilities with sufficient parking for 40% of their fleet. In practice, only National approaches these ideals. One reason for desiring ample parking at the airport is that many firms prefer to make their airport facilities the hub for their region-wide operation, as National does, and to shuttle cars from airport storage lots to downtown and suburban offices.

Site visibility is primarily important only relative to competing firms. It is recommended that airport car rental facilities not be permitted to compete with airport directional signs for visibility on the Inbound Terminal Roadway. Car rental facilities should continue to be clustered in a single area, the Southwest Service Area, so as not to single out firms for advantage or disadvantage by virtue of site location.

It is questionable whether there should be an effort to consolidate ready-car and check-in facilities for each firm on a single site as at National. Continued use of central area parking for ready-cars has advantages in convenience for rental-car users and utilization of scarce land over location of ready-cars in the Southwest Service Area. The roadway improvements described in Chapter 8 attempt to improve the circulation between the central ready-car area and the terminals and Southwest Service Area.

Off-Airport Facilities. Several small firms are located off-airport in the Orleans/Porter Street area, around Day Square, and on C-1 north of the airport. The locations in residential neighborhoods cause land use conflicts and should be discouraged by joint efforts of Massport and the East Boston community. Access via Porter Street is a significant factor in encouraging location of these facilities in Jeffries Point; the potential for closing Porter Street to discourage these uses is discussed in Chapters 4 and 8.

Airport Traffic Impacts. Car rental vehicles constituted approximately 10% of all passenger related traffic to the airport in 1979. This contributes to the general problems of cross-harbor access traffic congestion and environmental impacts. An additional problem is caused by the large volume of rental car shuttles using the terminal curbs and roadways. As discussed in Chapter 6, it may be necessary to restrict the operation of such shuttles, either by providing common service, or, perhaps more acceptable to the car rental firms, requiring that each firm's shuttles carry other firms' customers as well as their own. This would allow firms to compete on a service basis and preserve headways with a fraction of the existing shuttle fleet.

Future Facility Requirements

It is assumed that efforts to reduce automobile use at Logan will discourage rental car usage as well, but to a lesser degree than private automobiles. Nonetheless, overall growth will approximate growth in airline passengers, which is forecast to be substantial. A maximum shift of 15% of car rental demand to multi-passenger modes may be possible by the year 2000. Major uncertainties in future air travel growth and in automobile use make it difficult to predict future car rental facility needs.

Future facility requirements should be based on the current parking to fleet ratio of 25-27%, rather than the ideal ratio of 40%. Assuming a passenger growth factor of 2.6 by the year 2000, and a 15% reduction in automobile use, approximately 4900 car rental parking spaces, and a total site area of 1.6 million square feet would be needed in the year 2000. Approximately 1000 ready car spaces would be needed for the projected car rental demand in the peak three hours of the forecast day. These ready-car parking spaces should be provided in the central area, in a structure if overall land constraints require it. The remainder of car rental facilities can be accommodated in the Southwest Service Area as shown in the Development Packages described in Chapter 3.

Service Area Redevelopment

Redevelopment of the Southwest and North service areas is a relatively high priority after the Bird Island Flats development is underway. Parcelization and redevelopment of these areas has been studied. Redevelopment can be accomplished without large capital investment except if lease termination and acquisition costs are incurred, therefore, redevelopment should be staged to follow lease expirations (see Figure 3.2).

Staging considerations make it desirable to postpone actions such as relocation of the air mail facility, but achievement of the land use zone organization presented in Chapter 3 should be a long term objective; interim uses should be regarded as legitimate but "non-conforming" in analogy to municipal zoning.

Southwest Area

Access will be substantially altered by the construction of the BIF access roadway. Interim provisions must be made for airside vehicles to cross this road safely and securely when they are bound for the airmail, forwarder and food preparation facilities.

Existing car rental, cargo and forwarder facilities are expected to remain, although car rental parking areas are flexible and can be somewhat changed in shape and location. This should be done to the extent necessary to rationalize secondary circulation.

The principal change in this area will occur in the area to be vacated by general aviation facilities. The dimensions of this area allows division into parcels of 150,000 - 200,000 square feet with allowance for a buffer area along Maverick Street. Development Package 1 (Figure 3.4) shows this area used for car rental facilities; demand for such facilities appears to exist now. An alternative use for this area is shown in Development Package 2 (Figure 3.5); a continuous line of buildings used for freight forwarding or food preparation would act as an active barrier to truck noise and is compatible with a buffer along Maverick Street. Buildings with access only on the airport side are superior in their environmental characteristics and compatibility as a buffer.

Several transitional parcels not integral to the main Southwest Area lie in or next to the community. These parcels will be of little use for airport functions in the future and might be converted to other uses.

North Service Area

This area comprises the North Apron, airport maintenance area and areas surrounding the remaining Neptune Road residences.

Part of the North Apron may be needed for expansion of terminal facilities. The remainder should continue as a major area of aircraft apron for air freight and aircraft maintenance. Apron layout may be changed in two ways: 1) by reducing the depth of the TWA leased aprons to the extent necessary to provide adequate clearances for large aircraft if the terminal area is extended; and 2) by acquisition or lease of the Robie Airport Park land to expand the west end of the apron area to a more usable shape.

Development Package 1 shows the redeveloped North Apron without expansion; Package 2 shows it with expansion.

A third possible change would be to realign the Prescott Street extension serving Delta and TWA facilities to parallel the south edge of the apron; this would make apron rectangular and increase its usefulness at the east end. The improvement does not warrant demolition of the existing facilities but should be implemented in the very long-range future when they are redeveloped. (The existing facilities remain in both Development Packages.)

No changes are foreseen in the fuel farm area as it presently exists. Massport estimates indicate that the volume of storage which presently exists at the airport is adequate for a two-day supply for all operations forecasted for the peak period in the year 2000. Fuel farms at the airport should be used for settling of impurities and for short-term reserves; long-term storage reserves should be located off-airport in one of the areas now in such use. While the total storage volume appears to be adequate, some individual carriers have inadequate short-term storage while others have more storage under lease than necessary. Resolving this imbalance will require continued effort by Massport as leases are negotiated, and some additional fuel storage may be necessary despite such efforts. One potential site for additional storage is an unutilized parcel under lease to TWA northeast of its cargo loading and parking area.

The service road which skirts the Robie Area should be realigned at the Pan Am cargo building when it is redeveloped, and at Robie if a right-of-way parallel to the MBTA can be acquired. Widening this roadway to four lanes is desirable.

Both Development Packages include a direct service road connection to and from the highway north of the airport (See Chapter 8). The airport maintenance area can be expanded on its present site and a remote parking area can be developed on land adjacent to the Marriott Kitchen and Wood Island MBTA station. However, access to these facilities will cause environmental impacts on the houses that remain in the Neptune Road area. In the long run, it is anticipated that the houses will be acquired under the on-going program; the vacated area is shown as an undeveloped land bank in the Development Packages.

Figure 10.1

Interrelationship of Terminal Area Improvement Options

○ Projects Independent

* Projects Interrelated

✱ Projects Strongly Interrelated

	Southwest Options 1-3	Southwest Option 2	South Option 1	South Option 2	North Option 1	North Option 2	North Option 3	Volpe Option 1	Volpe Option 2	Volpe Option 3	Move Down-ramp	Bypass to Volpe	Elevated Busway	People Mover	Garage Extension	Additional Garage
Southwest Options 1-3			○	○	○	○	○	○	○	○	○	○	*	*	*	○
Southwest Option 2			○	○	○	○	○	○	○	○	○	○	*	*	*	○
South Option 1	○	○			○	○	○	○	○	○	○	○	○	○	○	○
South Option 2	○	○			○	✱	✱	○	○	○	○	○	○	○	○	○
North Option 1	○	○	○	○				*	*	*	*	○	○	✱	○	○
North Option 2	○	○	○	✱				✱	*	*	*	○	○	✱	○	○
North Option 3	○	○	○	✱				✱	*	*	*	○	○	✱	○	○
Volpe Option 1	○	○	○	○	*	✱	✱				✱	✱	✱	*	*	✱
Volpe Option 2	○	○	○	○	*	*	*				✱	✱	✱	*	*	✱
Volpe Option 3	○	○	○	○	*	*	*				✱	✱	✱	*	*	
Move Down-ramp	○	○	○	○	*	*	*	✱	✱	✱		✱	○	○	○	○
Bypass to Volpe	○	○	○	○	○	○	○	✱	✱	✱	✱		*	*	✱	*
Elevated Busway	*	*	○	○	○	○	○	✱	✱	✱	○	*		✱	○	✱
People Mover	*	*	○	○	✱	✱	✱	*	*	*	○	*	✱		✱	*
Garage Extension	*	*	○	○	○	○	○	*	*	*	○	✱	○	✱		✱
Additional Garage	○	○	○	○	○	○	○	✱	✱	✱	○	*	✱	*	✱	

Chapter 10 Coordination of Projects

The options described in Chapter 6, 7, and 8 for improvement of terminals, parking, and roadways have been designed to be as nearly independent as possible, so that they can be designed and built separately and in any order. This is intended to make the overall planning process less complex and more flexible in addressing uncertainty about future growth. Nonetheless, some interdependencies between projects exist.

This chapter contains an analysis of the interrelationships between each of the roadway, parking and terminal facility improvements described in the earlier chapters. The purpose of this analysis is to identify the extent to which facilities must be jointly planned or designed, or the extent to which construction staging is affected.

An example is the possibility of connecting Volpe Terminal to Southwest Terminal with an elevated busway. The relationship of these improvements should be considered before modifying access to Southwest Terminal in order that the access modifications do not foreclose later construction of the busway.

The general conclusion of this chapter is that there is a substantial degree of freedom in separately choosing and constructing potential improvement projects. Consequently, staging and development strategies can be developed relatively free of physical coordination issues. While a few projects are strongly interrelated and require coordination at the level of design, others can be addressed at the planning level; for example, through means such as reserving a corridor within which a busway could later be built.

Figure 10.1 summarizes the analysis of this chapter, indicating strong relationships between projects that will probably require design coordination and other relationships which may be satisfactorily addressed at the planning level. Other projects are physically independent, although issues such as financial planning require coordination among projects.

Implications for staging of projects are discussed in the following chapter.

Terminals

Southwest Terminal

The options for this terminal all involve relocation of the main Terminal Roadway up-ramp further to the west to separate the choice of arrival/departure level from the choice of terminal. Reconstruction of access will require the share-a-cab pool to be modified. This part of the terminal improvement can be separated at a different stage, but it is closely related to the overall design of the terminal and garage circulation. If separate second-level access to the terminal is created, entry to the Southwest Terminal garage should be made possible at either level. This can be provided by maintaining a local ramp from the lower to the upper level as presently exists or by modifying the present garage entrance ramp to allow entry at the lower level.

The construction of a vehicular connection to central garage should include a pedestrian connection in the same structure. The vehicular connection can be part of an "air rights" garage extension above the main Terminal Roadway, as shown in Options 1, 3, and 4, or can be a simple connecting bridge. It is not recommended that a bridge be built first and parking decks later, however, because the disruption and special construction measures needed for work above the roadway would have to be incurred twice if the work is done in two stages.

Design of Southwest Terminal should allow for a second-level busway from Volpe Terminal to enter the local circulation. The design should also allow for a people-mover corridor along the west edge of the Central Garage at third level.

Connection to the Central Garage will require minor modifications in the garage circulation. Implications of the Southwest Terminal Garage options for extending Central Garage should also be considered; both circulation and structural considerations are relevant.

South Terminal

The options for extending South Terminal and garage are relatively independent of other projects. The Crash-Fire Rescue Station would have to be relocated in order to use the apron space at the ends of the extended terminal wings. The field lighting vault might be incorporated into the structure.

In Option 1, South Terminal access and egress would remain unaffected. Option 2 includes an entrance to Central Garage and terminal connection to Pier D. These project elements would interrelate strongly with the modifications to Pier D contained in North Terminal Options 2 and 3. Circulation in Central Garage must be coordinated with such connections.

North Terminal

Option 1 can be constructed as a first phase of Option 2; if this is planned the first phase should not extend beyond the structural division between the projects; i.e., the east edge of the 'air rights' garage in Option 2. A pedestrian connection from Central Garage to Pier A can be incorporated with the Option 2 garage connection and should perhaps be deferred until that garage is built. The interrelationships with South Terminal Option 2 have been noted.

Pedestrian and vehicle circulation improvements at Pier A should be coordinated with the improvements planned for Volpe; however the connection between the two terminals can be resolved in a number of ways in the available space, so the interrelationship is not strong. Layout of the terminal improvements at Pier A should allow the gate positions there to be used either by carriers with ticket lobbies in Volpe or by carriers with ticketing in Pier A or North Terminal; circulation should thus preferably be ample for both a secure corridor and a public corridor from Pier A to Volpe.

Although the North Terminal carriers are presently reluctant, architectural modifications of Piers A and D should not foreclose the eventual relocation of North Terminal ticket lobby facilities toward these piers to extend the usable curb area. At the least, terminal entrances should be made possible along Piers A and D.

Vehicular circulation at Pier A can be handled in several ways: Recirculate to a common exit with North Terminal, as shown in the Chapter 6 options, continue at two levels to join a two level roadway at Volpe, or down to a single level roadway at Volpe, or a combination of these sub-options. Volpe entrance roadways at the first and, possibly, second levels must be accommodated in the Pier A area.

Design of North Terminal improvements should attempt to reserve a corridor to be maintained for a people-mover branch along the north face of Central Garage at the third level.

Volpe Terminal

The potential improvements proposed for Volpe could be implemented in several phases: east terminal wing, garage in one or two phases, extension of lobby space in the existing terminal, west wing and second level roadway.

The terminal east wing must be related to Pier A improvements as described above. The use of Volpe Gate #1 must be temporarily discontinued during construction, and existing bus/limo parking must be relocated. This wing could utilize the three gate positions at Pier A, requiring relocation of Air New England, and two commuter airlines. The new wing should also provide lobby and federal inspection facilities for some of the existing Volpe gates, perhaps gates 1 through 4. It should be designed to permit either domestic or international use, probably through use of three terminal levels as in Volpe, which allows international arrivals to be segregated from departures.

The improvements at Volpe Terminal can be done in almost any order. The east wing is compatible with any of the terminal options and might be built first to maintain flexibility as long as possible. If one or more wings are built with the intention to double-deck the roadway as a later project, the new wings can be designed to work with either one- or two-level roadways: a second level departure lobby could be reached by vertical circulation from the lower level or directly from second level entrances that would be used after the second level roadway is built. A second level deck could be included in the earlier phase; it would function as a canopy until the second level roadway is built to meet it and would then become upper level curb space. This deck would allow future consturction of a second level roadway with less disruption to terminal operations than if the two projects met at the face of the building.

Construction of a second level roadway would require modification of the existing Volpe terminal lobby. This can be done in a number of ways: by penetrating the space-frame roof at several points and providing vertical circulation to the lobby below; by lifting the entire space-frame to create a second floor facade; or by raising the roof and building a second floor lobby.

The Volpe garage in Option 1 can be built in two phases if desired, either by building on half the available site in each phase or by building less than the final number of floors. In either case, the first phase would be designed to be extended to a full garage by including in the first phase adequate foundations and circulation for both phases. The garage should be designed to accept a later two-level roadway or terminal wings by providing for second-level vehicular entrances and pedestrian bridges to each terminal wing. In Options 2 and 3 separate garages serve the existing and new wings.

Circulation to Volpe would be improved by relocating the main Terminal Roadway down ramp to the west, allowing direct lower level access from the main roadway. The interface of Volpe area improvements with the ramp relocation is flexible.

A bypass roadway to Volpe would be possible with proper layout of Volpe circulation to accept the second level bypass and a ramp connection to the lower level.

A Volpe second level roadway would permit a second level bus way connection to Southwest terminal. There do not appear to be special problems in coordinating these projects. The exit from the Volpe second level roadway may involve a trumpet ramp to the Outbound Terminal Roadway at grade. This trumpet ramp and the elevated busway would penetrate the central area parking garage shown in Package 2 (Figure 3.5). This would increase the garage cost and divide garage floor circulation at the first and second levels, requiring access and egress at each end of the garage; division of the garage is consistent with its use for both rental-ready cars and long-term public parking.

Roadways and Circulation

Terminal Area

The coordination of the circulation elements with terminal improvements has been described above. Relocation of main terminal roadway ramps can be easily coordinated with improvements such as Volpe bypass road and elevated busway from Volpe to Southwest Terminal. The Volpe bypass would run beneath the elevated busway, through the area between the existing and new central area garages, and parallel to the people-mover corridor; some coordination is necessary among these projects. A Volpe by-pass could pose major conflicts with an extension of the existing Central Garage toward the West.

An extension of a rapid transit spur from the Blue Line into the terminal area has not been studied in any detail, but it would clearly require close coordination with any garage extension in the central area and with a potential people-mover system. A transit spur would not directly interrelate with terminal improvement options nor with relocation of the main Terminal Roadway ramps.

North-South Service Road Separation

Eight options for improvement of the Service Road intersection with the Terminal Roadway are described in Chapter 8. These options are all compatible with the terminal area improvement options with the exceptions noted below.

Option 4 includes an at-grade loop from the Inbound to Outbound Terminal Roadways that allows BIF traffic to exit to the highway. This loop would conflict with a Volpe by-pass roadway by causing substantial weaving traffic. The loop would cross the site of an additional central garage, requiring an additional penetration.

In Option 6, the partially elevated Inbound Roadway would descend to grade and then ramp up again to the second level Terminal Roadway after a short distance if the main up-ramp were relocated to the West as recommended; the resulting profile would be awkward.

Option 7, a fully elevated roadway, is incompatible with an elevated busway from Volpe to Southwest Terminals. If the outbound roadway alignment is north of the heating plant, the geometry will be poor in relation to Volpe Options 1 and 2.

Option 8, a two-way bridge east of the Hilton Hotel is consistent with the relocation of the Terminal Roadway ramps, an elevated busway, and a second level exit from Volpe. However, it would require an additional penetration of the central area garage as shown in Package 2.

All options except 3 and 8 shift the Outbound Terminal Roadway alignment to the present East-West Service Road alignment and might interfere with circulation for Volpe Option 2.

Chapter 11 Staging

This chapter uses the foregoing analysis and options to develop alternative ways in which projects can be staged over time. The sequence of actions is constrained by several factors. The thresholds for existing facilities indicate when improvements or management measures must first be undertaken. The capacity added by various facility options determines how much additional activity can be accommodated by an improved facility before a second improvement must be undertaken. The physical characteristics of the existing and proposed facilities determine the extent to which projects can be economically split into two or more stages and indicates where it is advantageous to combine projects.

The threshold analysis of terminals was described in Chapter 6 (see Appendix for more detailed technical explanation). The thresholds are general indicators of facility capacities, and are not precise measures. The thresholds which have been identified in this study should be regarded in light of several refinements which can occur either in the measurements themselves or in the facility operations.

Management techniques can increase the capacity of facilities without physical changes, for example policing the curb can greatly increase curb capacity. Refinements of thresholds may be needed where information was inadequate or not available. For example, some modifications in check-in procedures may already have occurred which would change the appropriate counter length/passenger capacity ratio for calculating the thresholds.

Thresholds in this report are given in terms of percentages of August 1980 activity. Passenger volumes are forecast to increase by approximately 40% of the 1980 base every five years. While annual passenger volumes may increase at a slower rate, peak hour volumes may increase faster owing to increased scheduled flights, increased load factors, or service by new carriers. (By the same token, peak hour volumes could instead increase more slowly than annual volumes.)

Thresholds are based on design criteria and assume average peak hour load factors of 75%. For these reasons, thresholds are inherently approximate and should be regarded as meaningful only within a range of plus-or-minus 15-20%. This leeway of 30-40% also provides some slack for shifts in commuter carrier volumes and the potential effects of deregulation (such as the rapid emergence of New York Air or Air Florida).

The thresholds for curb and parking assume that there is an on-going program to divert passengers from automobiles to mass transit modes. Diversion is presumed to reach 5% by 1985, 10% by 1990, 15% by 1995 and 20% by the year 2000.

The discussion of staging is necessarily in terms of real-time years, but, as explained above, the staging strategies may be stretched out or compressed in time depending on the rate of growth in airport activity. If activity at different facilities grow at different rates, the sequence of projects may also change. Means of dealing with these contingencies are discussed below.

Two strategies for managing resource flow are explored in this chapter: one defers investment as much as possible within the limits of thresholds defining "acceptable" congestion and delay; the second strategy avoids segmentation of projects and schedules larger investments as early as needed despite risk of over capacity if growth does not continue as forecast. These strategies result in quite different patterns of annual expenditure.

Improvements to Increase Terminal Capacity

As discussed in Chapter 6, Volpe and North Teminals are operating at or beyond capacity for curb and lobby functions. Southwest Terminal's curb and parking are near or beyond capacity and its baggage claim area will require action in the mid-range. South Terminal, on the other hand, will approach its thresholds only when passenger volumes have more than doubled from 1980 levels.

The following sections describe the effect on facility thresholds of the options developed in Chapters 6, 7, and 8.

Southwest Terminal

Internal Facilities. The ticket counter is approaching its threshold but can easily be modified in the available lobby area. The outbound baggage sorting area may reach threshold in the short-term despite the fact that shuttle passengers' baggage bypasses it. Baggage claim lobby may reach threshold in the mid-term and claim frontage in the long-term. Baggage handling and claim lobby can be enlarged by extending the baggage room onto the apron towards BIF in a manner similar to the enlargement, in 1979, of Delta's baggage room at North Terminal. These modifications are relatively minor and can be implemented quickly at any time.

Curb capacity can be substantially increased at the upper level by adding a deck with a curb island for use by buses and shuttles, freeing the curb nearest to the terminal for use by autos and taxis only. This deck can be added in two phases. In the first phase, a deck would be added between the ramps to and from the upper level. The second phase would be done only in conjunction with a relocation of the main roadway ramp to the west and construction of elevated access and egress roads directly to and from the second level main roadway; the new connections to the upper level curb would be located at the corners of the terminal allowing the curb frontage to be extended to nearly the full terminal width.

The addition of a center section of deck would increase the curb threshold from its present threshold at 90% of August 1980 peak demand to 160% (forecast year 1987). A 5% diversion from auto to public transit would further extend this threshold date to 1990. The maximum curb extension after construction of second level roadway connections would increase the threshold to 210% of the August 1980 peak demand (forecast year 1995). Increasing diversion of auto traffic to a total of 15% would extend the forecast year to 1999. Better policing of curbs combined with provision of adequate short-term parking could further extend the threshold at any stage as much as 60% beyond its capacity (see Chapter 6).

Parking for Southwest Terminal can be increased in a number of ways, but it is recommended that the selected option include a vehicular bridge to Central Garage, probably at the third level. This connection immediately permits fuller utilization of existing spaces and satisfies parking demand at Southwest Terminal regardless of the amount of future growth, thus maximizing flexibility; a separate parking structure for Southwest, on the other hand, may turn out to be over- or under-built, depending on the rate of future growth. A pedestrian connection can be provided in the same structure.

Parking decks can also be built between the terminal and Central Garage above the main roadway. If such "air-rights" parking is built, it should be done at the same time as a bridge to minimize disruption and to avoid repeating special construction practices such as detours or shielding above the main roadway.

A simple bridge to Central Garage would improve parking circulation for Southwest Terminal but not extend the combined threshold for North and Southwest which is 140% of the April 1979 demand (forecast year 1985). If an additional 1200 spaces are built, plus a bridge to Central Garage, the threshold would be increased to 200% of the April 1979 demand (forecast year 1989).

South Terminal

South Terminal has more than adequate gate, lobby, and curb capacity for peak hour volumes 200-300 percent of present volumes. Some individual airlines facilities such as ticket counters and baggage claim may be closer to threshold but can be modified without great expense or disruption. Parking, however, may become insufficient by

1995 at the forecast growth rate even with a 15% diversion to public transit by that year. If this deficit occurs, parking can be increased in the central area or in remote lots, and passengers can be brought to the curb by shuttle. Alternatively, the South Terminal garage can be extended toward BIF, displacing the fire station and incorporating the field lighting vault. (The South Terminal lobbies could also be extended and three gates adequate for wide-body aircraft could be added.)

North Terminal

The projected requirements for North Terminal do not indicate a need for complete rebuilding or major gate expansion even in the long-term. Although the present facility is not well designed to handle the landside demands of the forecast passenger loads, the extreme disruption caused by major reconstruction is not clearly outweighed by the resulting increase in convenience.

Internal facilities are congested at peak hours, particularly TWA's ticket area and baggage sorting area, which receive heavy peak loads due to TWA's wide-body aircraft. Delta's baggage area was recently expanded but operates near its threshold in peak hours; this situation is mitigated by Delta's relatively high proportion of transferring passengers and use of outside space for baggage transfer.

Curb. North Terminal's most critical problem is curb space. The upper level curb is already past threshold at peak hour; the lower curb has a longer total frontage but is not well utilized owing to cramped layout and use of a large proportion of curb space for bus and limo layovers. Activity at North Terminal's curb is strongly influenced by its largest tenant, Delta Airlines. Delta's schedule clusters arrivals and departures into hours of full use of its gates alternating with hours of no activity; this scheduling strategy, which aims at facilitating transfers, makes it likely that activity will continue to be concentrated in peak hours rather than spreading to adjacent hours.

Immediate extension of the North Terminal curb and lobby area is desirable, and this is currently being planned by Massport. A first phase implementation of the curb extension envisioned in North Terminal Option 1 (See Chapter 6) would increase upper level curb to a total of 1550 linear feet. If 220 feet (one traffic island) were reserved for upper level bus and limo use, the curb threshold would be extended to 140% of the August 1980 peak hour level which would be adequate through the 1985 forecast year. A 5% diversion from auto use would further extend the threshold by one forecast year to 1986.

Further extension of the North Terminal curb as provided in Option 2 can be accomplished as a later phase consistent with Option 1. This would extend the upper level curb capacity to twice the August 1980 peak hour demand; with a 15% diversion from auto use this would extend the threshold to the 1996 forecast year (or beyond, if peak hour activity spreads to adjacent hours.)

Lobby facilities should be expanded into Pier A in the first of these phases; expansion into Pier D is presently not favored by United but may be desirable in the second phase.

Parking for North Terminal is provided largely in Central Garage, which also serves Southwest Terminal. Central Garage is adequate for 170% of the April 1979 daily demand from both terminals, which corresponds to forecast year 1985. If parking is added in the short-term at Southwest Terminal, the threshold would become 200% of the April 1979 demand (1989). Beyond this level additional parking should be added by extending Central Garage either to the west or between the garage and Pier A in the "air-rights" above the main roadway and curb area. If 1000 spaces are added in addition to those at Southwest Terminal, the combined parking threshold for the two terminals would be 230% of the April 1979 daily demand, adequate through threshold year 1991 if a 10% diversion from automobile use is achieved by then. A final addition to the Central Garage or provision for remote parking with shuttle to the terminals would then be required.

Parking facilities have a great deal of influence on the use of curb: if the parking space is far from the terminal lobby and if it is difficult to drive from the curb to the parking space (for departures) or from parking to the curb (for arrivals), the curb will be used for illegal parking (See Chapter 7). An overhead garage, as proposed in Option 2, managed so as to reserve short-term spaces near the terminal would help shorten the walk to the terminal lobby. Direct ramps between the garage and the terminal curb would provide the necessary vehicular connections. It is recommended that a garage exit drum ramp to the lower level curb be constructed near the Control Tower. A garage entrance should be built at the Pier A end of the curb. These improvements should be made in conjunction with the curb and lobby improvements to minimize disruption.

North Terminal gates will accommodate a future fleet mix heavily shifted toward wide-body and new generation narrow body aircraft. There can be an expansion into the three gate positions along Pier A if new international gates are provided to the west of Volpe, and one additional potential gate position in the Piedmont area can be utilized, but no other expansion of gates seems possible or desirable at North Terminal. Further expansion of domestic operations should, if necessary, take place at terminals where landside facilities are more able to handle peak loads.

Volpe Terminal

Internal Facilities. No single threshold can be assigned to ticket lobby for Volpe carriers since these facilities are divided into small sections which are not shared. Ticket counters are arranged in several short piers extending into the lobby space. Each side of a pier should be roughly adequate for one 747 departure; however, the spacing between piers is inadequate for use by adjacent carriers at the same time. Hence, localized congestion occurs when schedules coincide. Although this pattern is difficult to predict, the frequency of problems will clearly increase with the number of flights. Ticket lobby congestion should be addressed by scheduling or in conjunction with terminal extensions to relieve customs, curb and gates.

Outbound baggage areas should not be a problem since no sorting is required for most Volpe users. The adequacy of carrier lease areas should be checked when other improvements are being programmed and designed.

The customs and immigration area was at its threshold in August 1980, with considerable congestion expected when load factors exceed 75% in the peak hour. The addition of a single additional arrival in the peak hour may create serious problems. In the short run, coordination of schedules is recommended and the use of a temporary customs shelter should be considered. A permanent increase in customs space should be provided when financially feasible.

Curb. Activity at the Volpe curb was at 150% of its threshold at peak hours in August 1980, with problems concentrated in front of active ticket counters and compounded by the mixture of buses and shuttles with automobile traffic. An inexpensive action which could be taken immediately is the creation of an island curb lane which buses, shuttles and limousines would be required to use. (See Chapter 6.) The additional curb lane would displace up to 60 parking spaces. Curb capacity would be increased to 95% of August 1980 peak demand, a gain of five forecast years worth of growth.

Curb length can be further increased in two ways: (1) by double-decking the existing roadway which requires modification of the existing terminal lobby but would improve its flexibility for domestic use; and (2) in conjunction with extending the terminal.

A 450-foot terminal extension is recommended in the near-to-mid term. This wing would be perpendicular to the existing terminal and extend to the two-story section of Pier A. It would provide adequate lobby and customs area to serve existing gates and possibly the three potential gate positions along Pier A.

If the new wing is provided with an island curb lane, the threshold for Volpe curb would be 150% of August 1980 peak demand (adequate through the 1987 forecast year or until 1990 if 10% diversion of automobile use is achieved).

If it is decided to double-deck the circulation at Volpe, this could be accomplished either at the same time as construction of the wing just described or as a later project. If the decision to double-deck is made early, the new wing can be designed to operate with entries at either one or two levels; a second level concrete deck would be built as a canopy in the first stage and would, in a later phase, be met by the second level roadway and converted to elevated curb space. This deck would allow future construction of a second level roadway with much less disruption to the terminal's operation than if the deck were part of the later phase of work.

The construction of an extension on the Pier A side of Volpe avoids a termination of the American Airlines cargo apron lease which runs through 1990. The location between Volpe and North Terminal allows the three gate positions along Pier A to be used as "swing" positions for either international or domestic flights.

Gates. The existing gates at Volpe will accommodate nine Boeing 747's simultaneously. The amount of growth that could be accommodated by the existing gates can be put in perspective by calculating the upper limit of passenger volumes that could be handled on nine such planes at a 75% load factor. This represents a single hour departure threshold of 170-180% of the passengers that could be carried by the flights scheduled in the August 1980 peak hour (or 200% to 220% if the present mix of arrivals with departures becomes all departures). The forecast date of this threshold is affected both by the number of flights (more flights implies earlier threshold date) and the extent to which the departure peak can be spread to later hours (more spreading implies later threshold date). Ten years is a possible planning horizon at the forecast growth rate. However, because of the mix of aircraft actually used, gates are unlikely to serve this many passengers when fully scheduled.

Based on the forecasts, as many as 14 gates could be needed by the year 2000 to satisfy peak hour demand for international travel and Volpe's 1980 share of domestic flights, plus up to seven additional positions for aircraft laying over between afternoon arrivals and evening departures. It is recommended that a second Volpe extension providing increased lobby space and two additional 747 gates be planned for around forecast year 1990. This extension could accommodate up to a total of seven additional 747 positions by use of a pier or transporters connecting the terminal to apron space on the American Airlines hangar site. The three gate positions at Pier A for three-engine wide-bodies could continue to be used for international operations if demand warrants, or these three gates could be used for domestic flights and the international aircraft accommodated entirely at the existing central wing and new west wing of Volpe.

The construction of the west wing of Volpe could take place in two stages to delay removal of the American Airlines cargo building. The first stage could extend the new wing to within 50 feet of the cargo building, taking the freighter apron but allowing it to continue to function for belly cargo.

If the double-decking of Volpe is decided upon but not constructed prior to construction of the west extension, the two projects should take place together.

It is recommended that extensions to Volpe be designed to allow cross-circulation between existing and new lobby and gates. This will permit existing gates at the ends of Volpe Terminal to be served by new lobby and curb and will allow the pairing of gates and lobby areas to be adjusted as necessary when new space is added, gates reassigned to domestic use, or new carriers and schedules added.

Parking at Volpe exceeded the capacity of the available lots in 1979 but, despite a slight increase in passengers, parking was adequate in 1980. This may be a result of schedule changes or peak hour load factors that reduced the demand for short-term parking. The two present parking lots (one is at Pier A) are nearly at capacity. A total of 2000 parking spaces is forecast for Volpe by the Year 2000; however, three-fourths of these spaces are expected to be used by short-term parked cars. The short-term spaces may be occupied only 6 to 10 hours per day, making it questionable whether a garage would be financially feasible. If a garage is to be built it could be constructed in two phases of 1000 cars each.

Infrastructure Improvements

Infrastructure improvements of several kinds are either necessary or desirable to handle the forecast passenger loads. The intersection of the North-South Service Road with the main Terminal Roadways is presently approaching capacity. Since the design of improvements to this area is strongly influenced by the possibility of a Third Harbor Crossing, it is recommended that only interim minor improvements be completed immediately. Although traffic engineering studies are not complete at this writing, interim improvements may extend the intersection capacity to the 1987 forecast level. More permanent improvements to increase capacity by separating terminal and service traffic should be completed by the time that level of traffic is reached.

The terminal area roadway loop has adequate capacity for year 2000 forecast levels, although some congestion and consequent diversion of traffic from the two-lane upper level to the three-lane lower level may occur at some times. However, it is recommended that the main ramps to and from the second level terminal roadway be relocated to the west.

Relocation of the up-ramp will reduce confusion by physically separating the choice of arrival/departure level from the choice of terminal. Relocation of the down-ramp will allow Volpe Terminal to be reached directly from the lower level. These improvements are not triggered by specific thresholds, so they can be undertaken immediately or delayed indefinitely. It is recommended that they be phased in conjunction with improvements to circulation at Southwest, North, and Volpe Terminals to minimize the number of periods of construction disruption.

Busway or people-mover connections between the terminals and extension of rapid transit into the airport may be desirable in the future. An elevated busway making a direct connection from Volpe to Southwest Terminal can be implemented if the Volpe loop is double-decked and can immediately follow that improvement. A Blue Line Extension is not likely to be feasible prior to 1990. It should be planned in relation to Central Garage extensions since the terminus of this transit spur should be as close as possible to the terminals. Similar coordination also applies to a people-mover system which must be designed in relation to improvements at Pier A and Southwest Terminal.

Overall Staging Strategies

Two alternate strategies have been developed for staging the two development packages described in Chapter 3; Strategies 1A and 1B apply to Development Package 1 and Strategies 2A and 2B to Development Package 2. Strategies 1A and 2A attempt to segment projects as much as practical and to defer investment as much as possible. Strategies 1B and 2B avoid segmentation of projects and schedule investments as early as possible.

These strategies are illustrated in the following exhibits. For each strategy there is a detailed schedule of projects and related actions by year (Figures 11.1-11.4), and a bar chart showing the estimated yearly expenditures entailed by the strategy (exclusive of relocation and financing costs) both in constant dollars and escalated at 8% per year (Figures 11.7-11.10). For strategies 2A and 2B, there are schematic staging diagrams showing the spatial location of projects over time (Figures 11.5 and 11.6).

Figure 11.1

Staging Stragegy 1A

▬ Lead Time

■ Construction Period

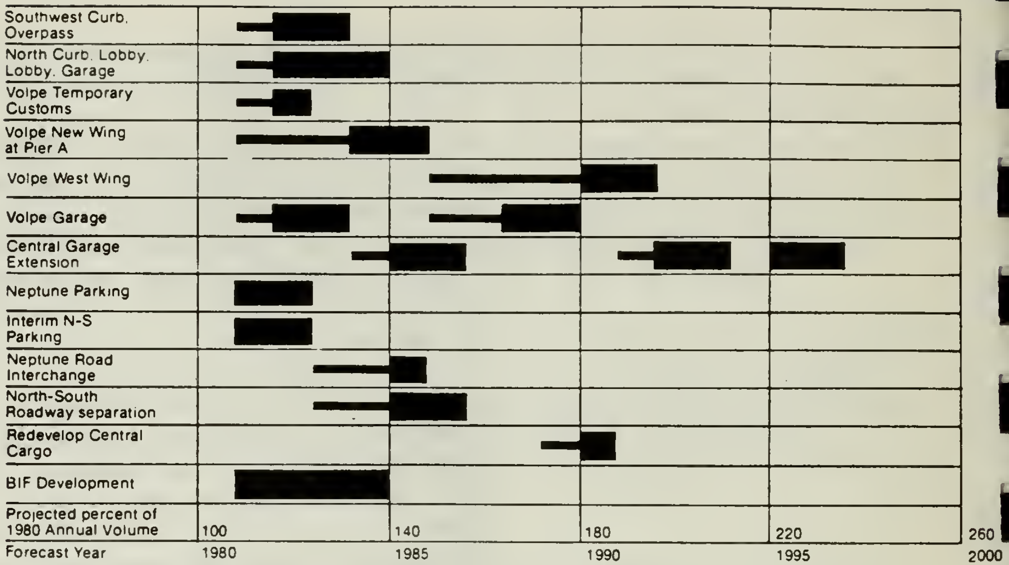


Figure 11.2

Staging Stragegy 1B

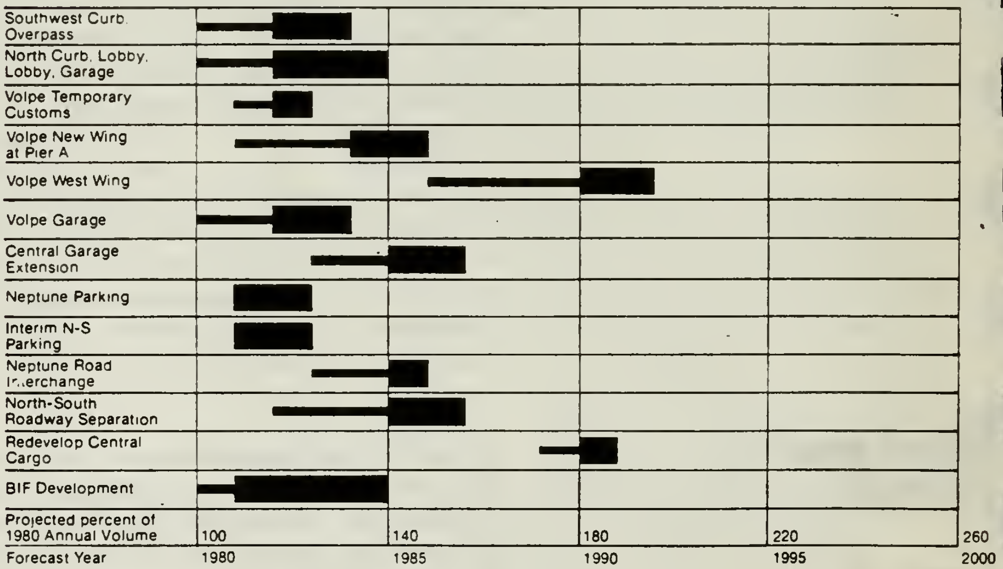


Figure 11.3

Staging Stragegy 2A

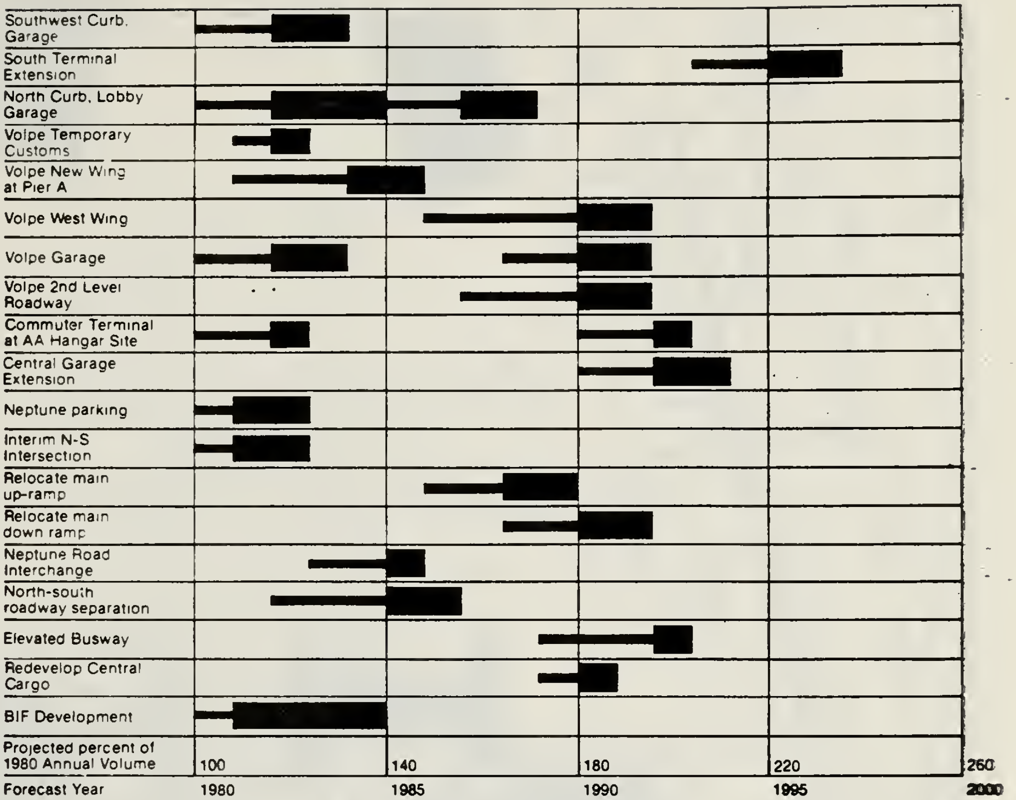
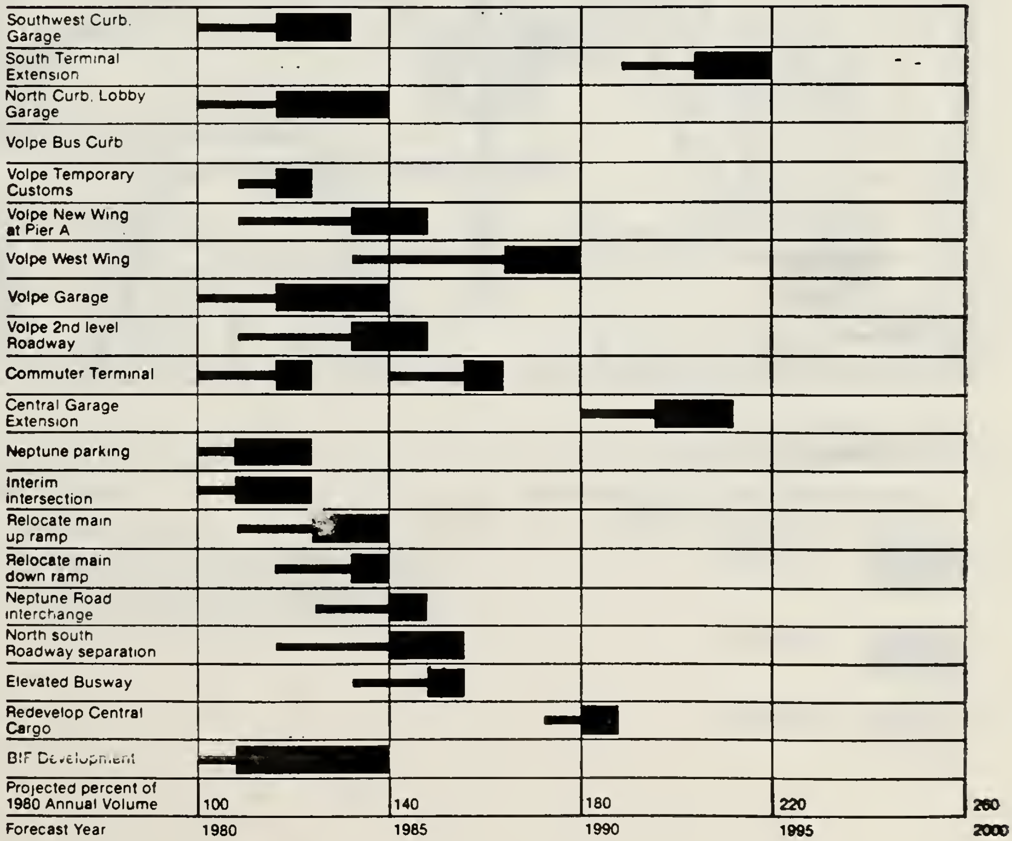
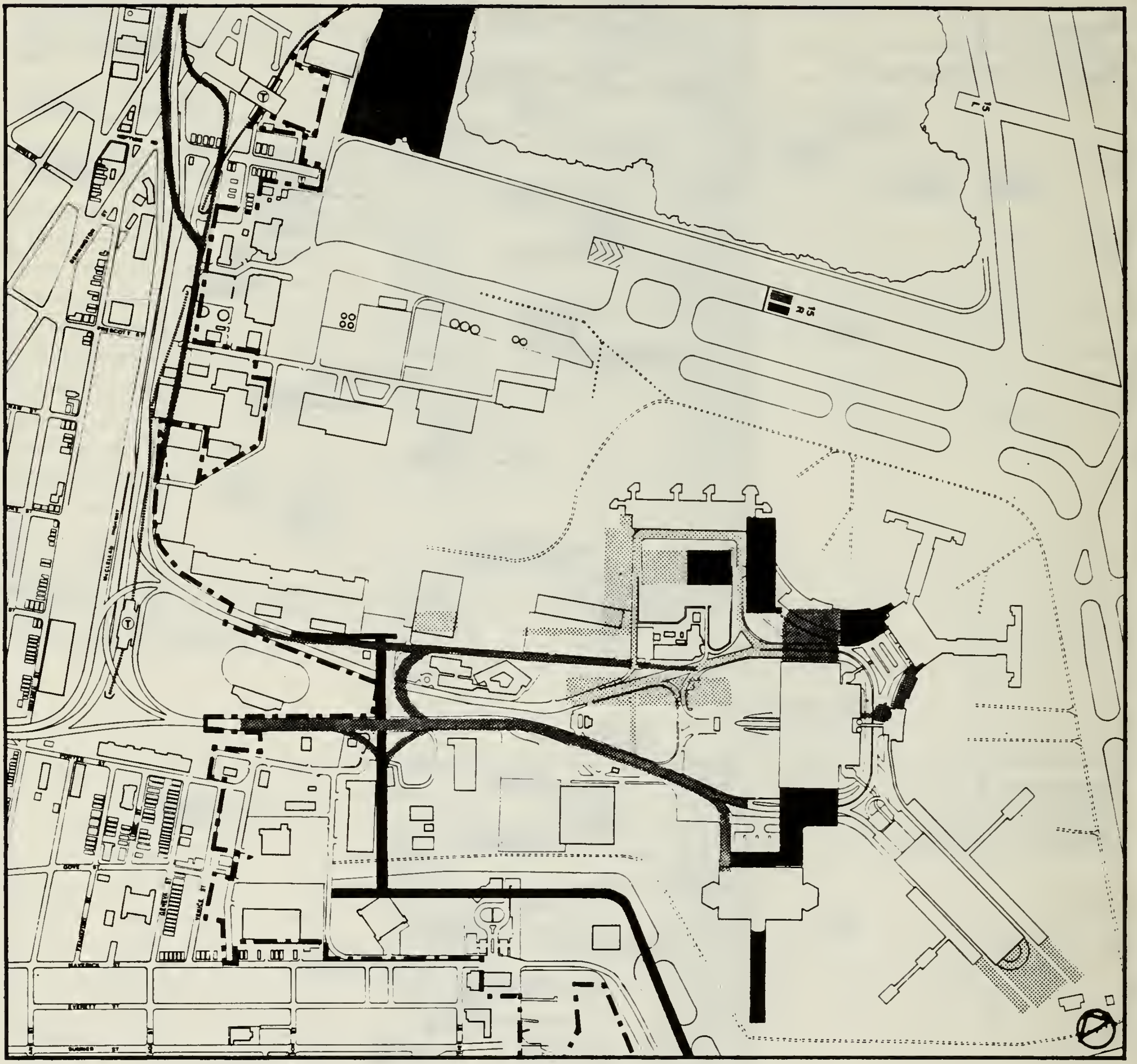


Figure 11.4

Staging Stragegy 2B





Staging Strategy 2A

Figure 11.5

Completion Dates

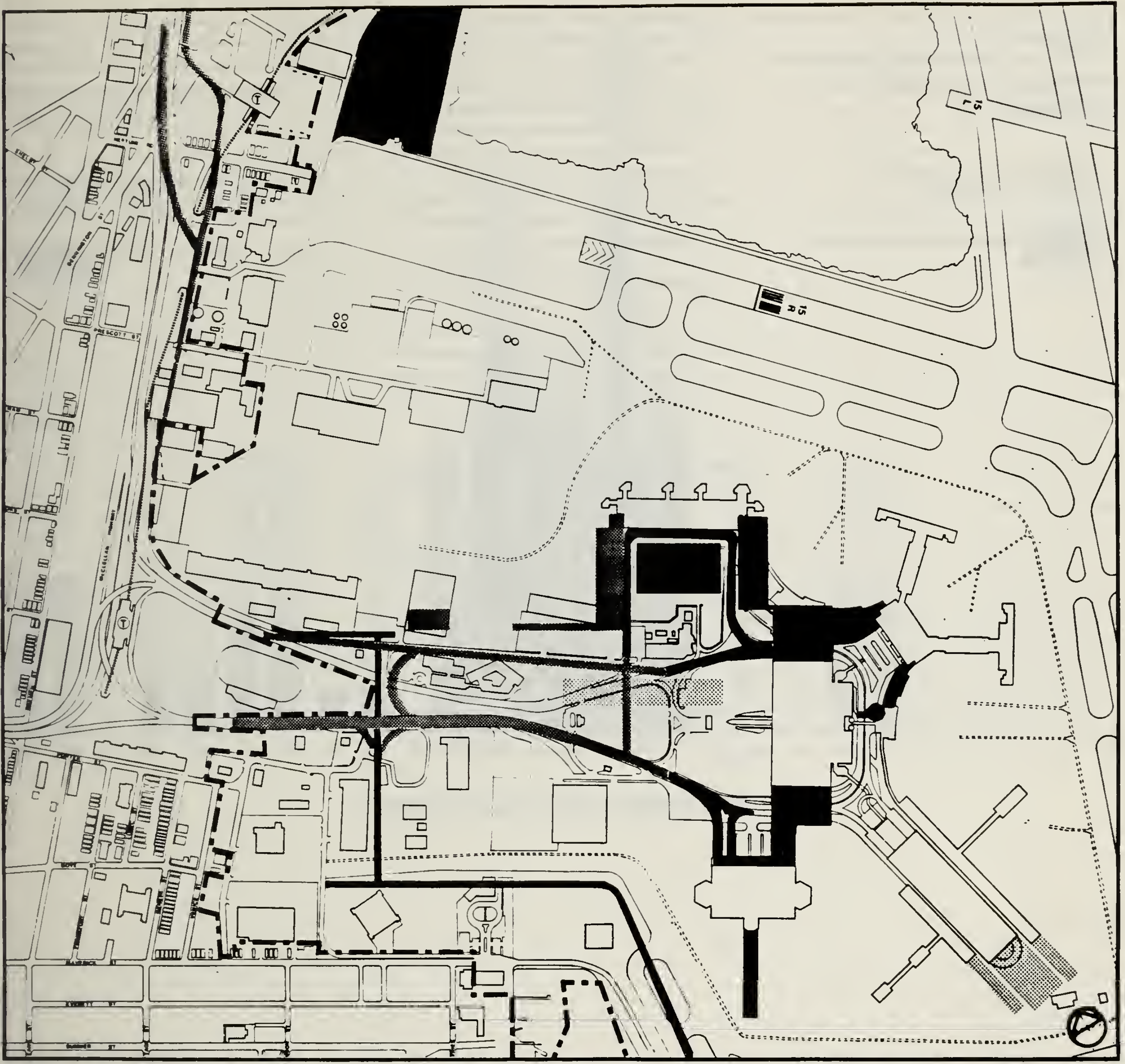
■ 1981-1984

▨ 1985-1989

░ 1990-2000

Not Shown:

1. BIF 1981-1987
2. Interim N-S Intersection 1981-82
3. Temporary Customs Shelter 1982



Staging Strategy 2B

Figure 11.6

Completion Dates

■ 1981-1984

▩ 1985-1989

░ 1990-2000

Not Shown:

1. BIF 1981-1987
2. Interim N-S Intersection 1981-82
3. Temporary Customs Shelter 1982

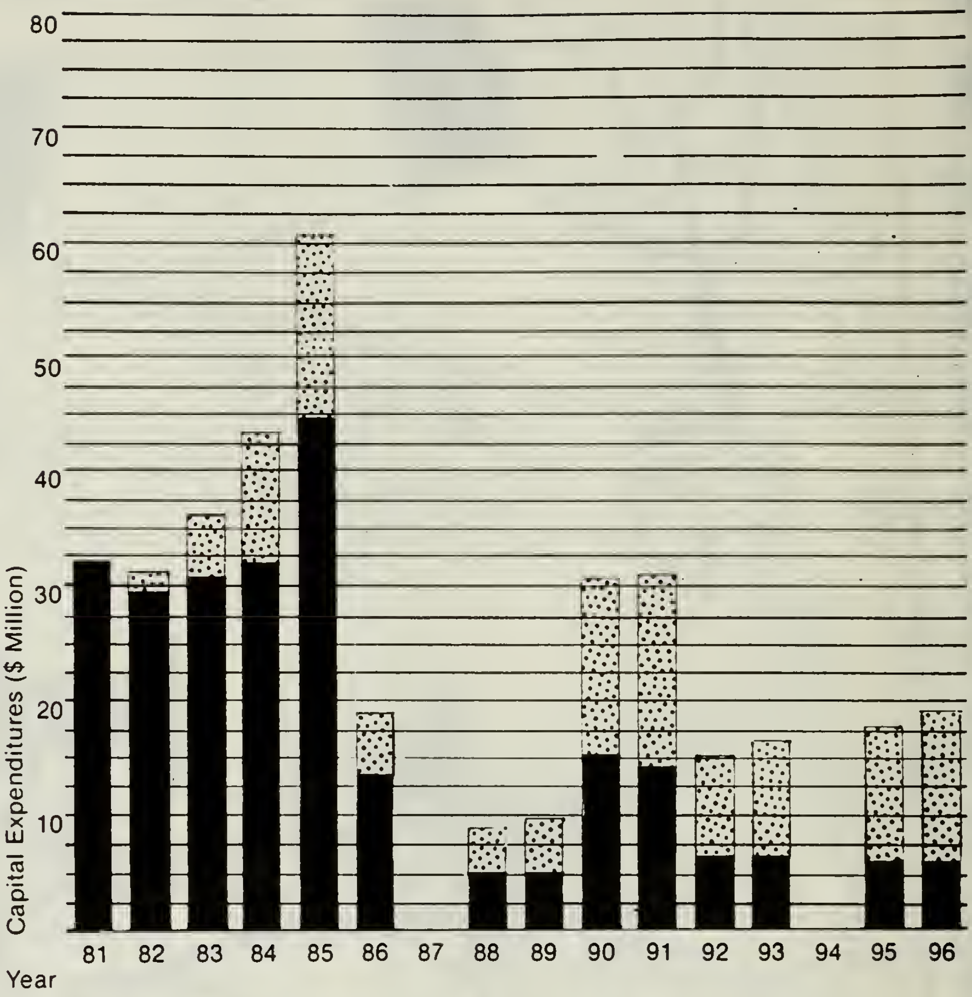
0 600 1200 feet 2400

Figure 11.7

Annual Expenditures Strategy 1A

▨ Escalated Cost (8%/year)

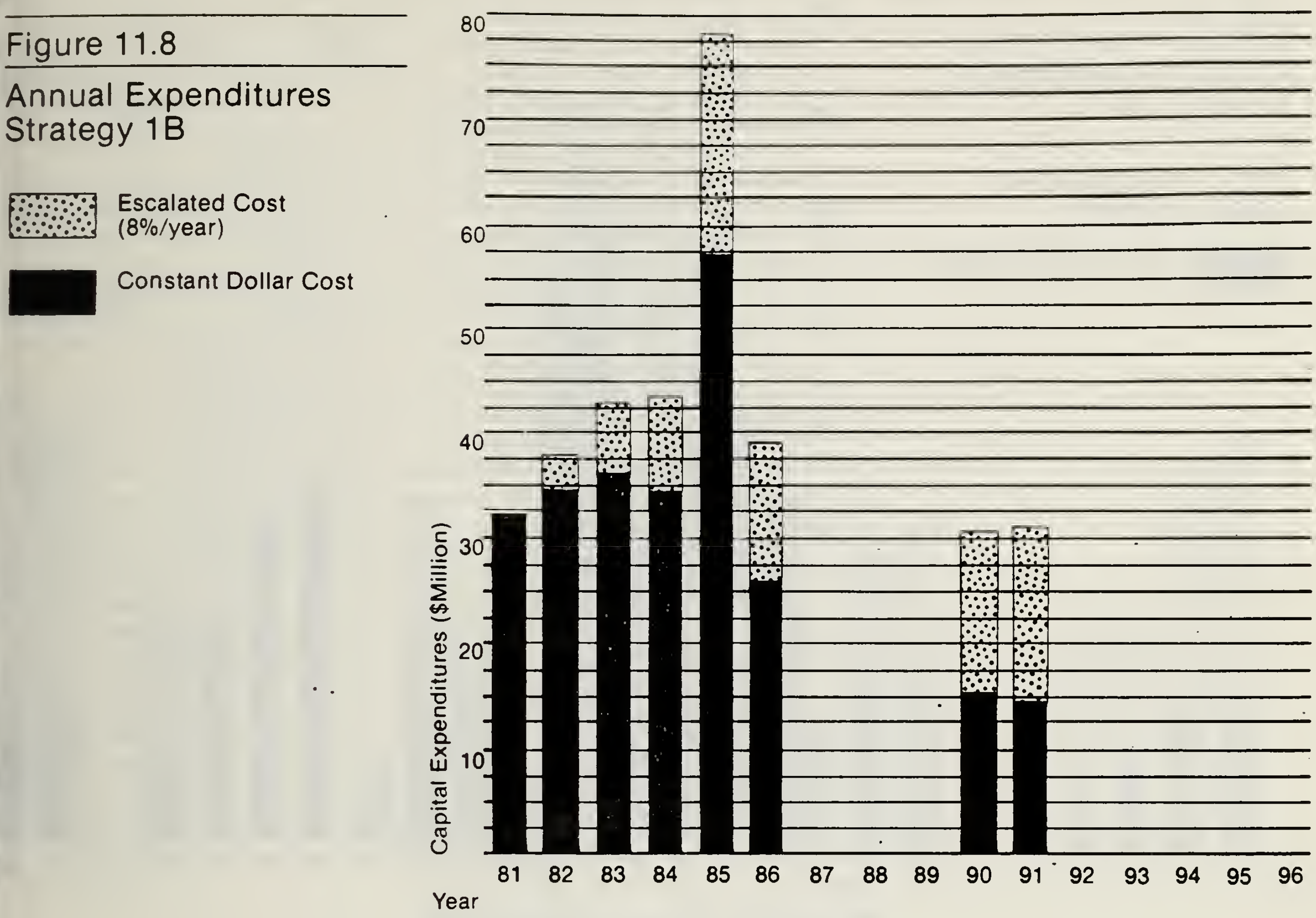
■ Constant Dollar Cost



Total Constant Dollar Cost: $251.2 million

Figure 11.8

Annual Expenditures
Strategy 1B



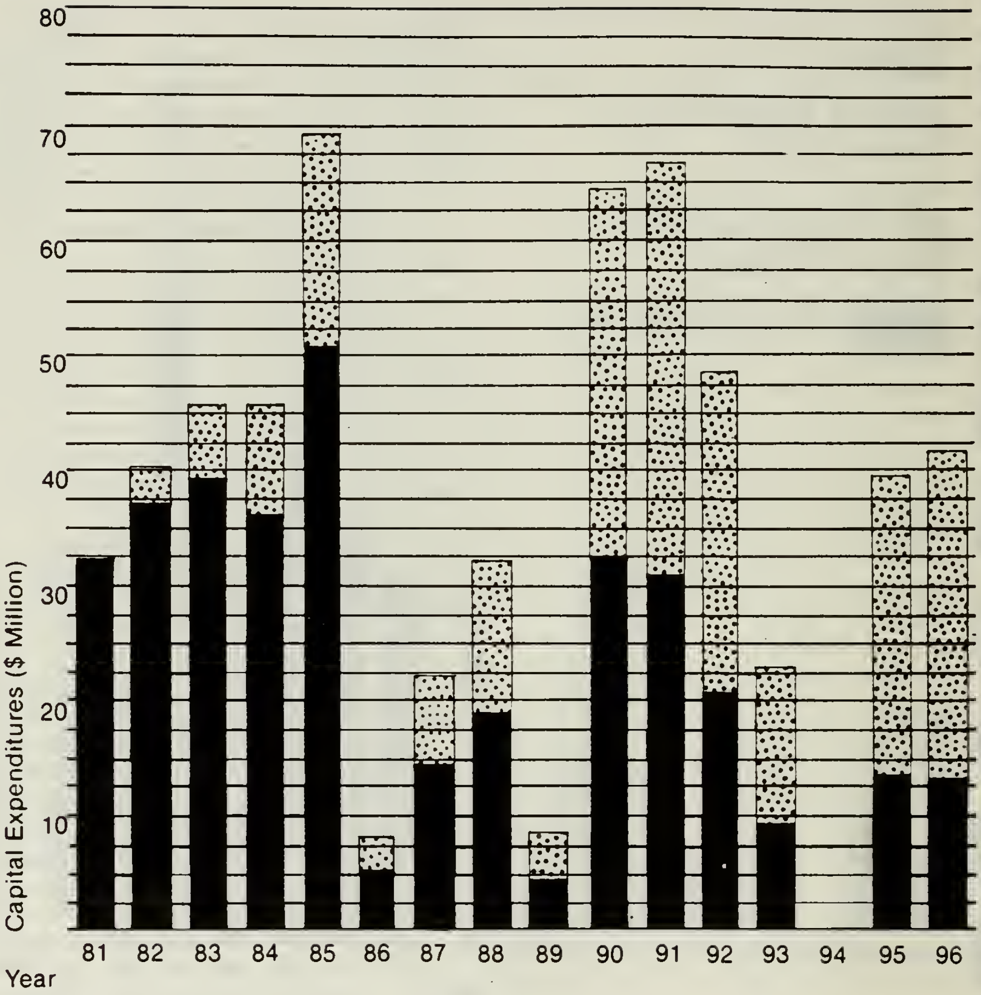
Total Constant Dollar Cost: $346.3 million

Figure 11.9

Annual Expenditures
Strategy 2A

▨ Escalated Cost (8%/year)

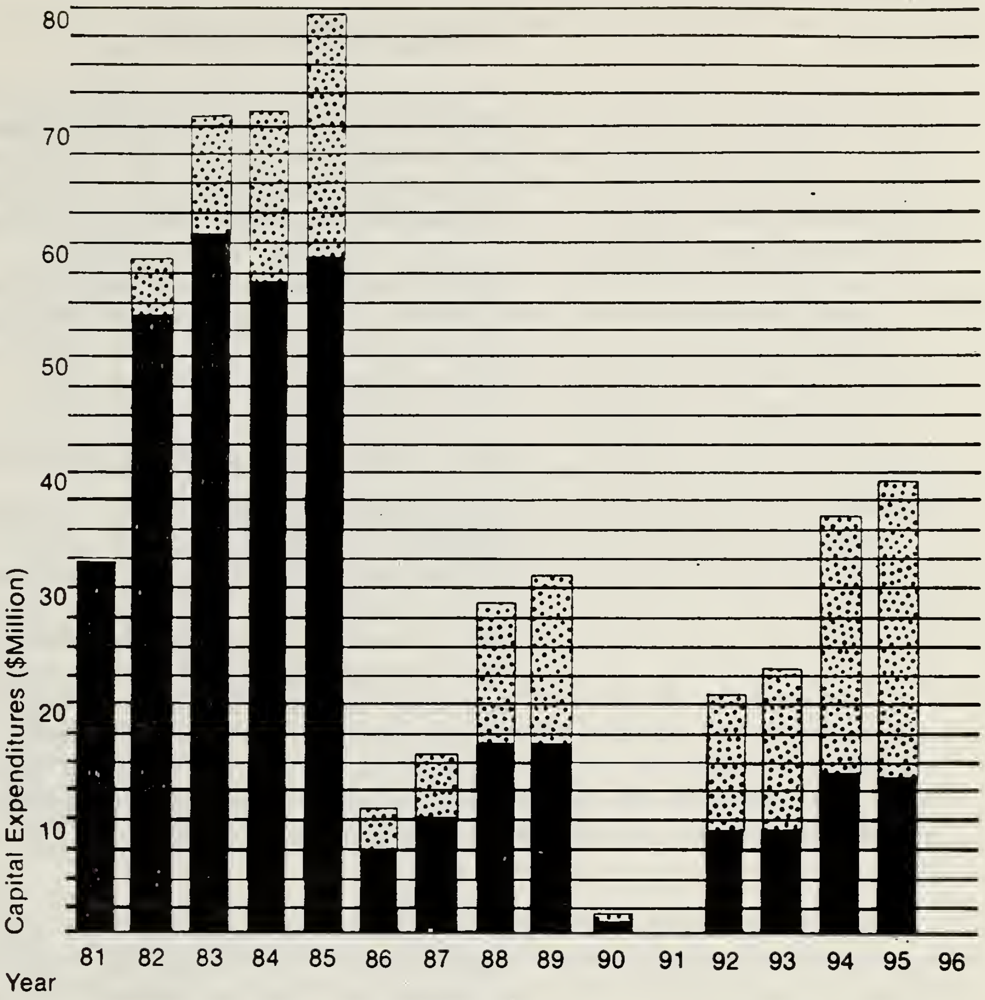
■ Constant Dollar Cost



Total Constant Dollar Cost: $251.2 million

Figure 11.10

Annual Expenditures Strategy 2B



Total Constant Dollar Cost: $346.3 million

Evaluation of Strategies

The principal considerations for choosing an investment strategy for a particular package, given that certain improvements will in fact be necessary are: the total cost of the improvements, the availability of funds at the appropriate times, and the flexibility of the strategy to adjust to future contingencies. The last of these considerations has been emphasized in this report as particularly important at this point in time. Yet another consideration is the amount of physical disruption caused by the staging of construction.

Total Cost and Availability of Funds

Development packages 1 and 2 have been selected to illustrate two investment levels. They differ particularly in the amount of parking provided close to the terminals and in the extent of roadway improvements. (See Chapter 3 for a more detailed comparison of the packages.) These differences amount to roughly $100 million (in constant dollars) between Package 1 ($251 million) and Package 2 ($358 million). Package 1 would improve terminal facilities and fully satisfy parking demand, but it would still involve considerable curb and roadway congestion and confusion which is relieved in Package 2.

The annual capital investment forecasts for each strategy are shown in Figures 11-7 to 11-10. The total constant dollar costs are equal for Strategies 1A and 1B, which are alternative staging schemes for Package 1 and for Strategies 2A and 2B, which apply to Package 2. The pattern of annual expenditures differs considerably among the strategies however.

Strategies 1A and 2A are based on deferred investment for their respective packages and have major annual investment requirements of $30 to $40 million in several years. Annual expenditures would exceed $50 million per year (in constant dollars) once for strategy 1B and three times for Strategy 2B. These major annual capital requirements occur principally within the next five forecast years. This could be an important factor in choosing which development strategy to pursue if the available funds are significantly tight during the upcoming years. One obvious consideration in choosing a strategy for future investment is the availability of funding after prior investment commitments, such as seaport improvements, are budgeted. Funding limitations may lead to further deferral than is shown in any of the strategies described here.

The total costs escalated over time are higher for the deferred investment strategies 1A and 2A, but this total has no significance until it is discounted to a present value; the significance of escalation is its relationship to the future cost of borrowed capital and the availability of other funds in the future.

On this basis, early investment Strategies 1B and 2B have a lower total discounted cost if financing is expected to become cheaper in the future relative to inflation. (If, on the other hand, inflation averages less than Massport's financing costs, Strategies 1B and 2B will turn out to be more expensive than the deferred investment strategies.) Strategies 1B and 2B also may have lower premium costs associated with project set-up and interim project items, such as parapets on garage floors that will be torn out when the floor is extended. (These premium costs are not included in the estimates below.) Finally, the early investment Strategies 1B and 2B reduce the number of times certain areas of the airport will be disrupted by construction, and they schedule the disruption early, when the volumes of vehicles and passengers affected will be smaller.

Flexibility

Another major consideration in choosing an investment strategy is the potential to change course in response to future events. These changes might be of several types: options for particular facilities may be altered, the overall level of investment reconsidered, or the investment strategy accelerated or deferred.

The deferred strategies 1A and 2A allow more freedom to make future adjustments, such as changing the airport's ground access orientation from automobiles to mass transit.

The overall rate of growth is likely to be different than forecast, since no forecast can be perfectly accurate. The effect of this difference would be to stretch out or compress the time-line that corresponds to future activity levels. To the extent that future growth is significantly slower than forecast, the payback period on early investments would be lengthened and fiscal losses could occur if facilities were substantially overbuilt. If growth were significantly more rapid than forecast, the Authoritiy's ability to finance and construct facilties rapidly enough might be strained.

Strategies 1A and 2A assume that overbuilding is a more serious risk than underbuilding. This position can be supported by arguing that overbuilding is damaging to the financial health of the Authority in an era of rising costs and scarce capital. Underbuilding, on the other hand, causes mainly temporary problems which can be addressed quickly from a position of fiscal strength. However, underbuilding may require shorter write off periods which could ultimately be costly and undesirable. Strategies 1A and 2A are the more conservative strategies with respect to environmental issues, since steps to increase capacity are taken gradually, allowing the extent of concomitant impacts to be observed before capacity is again expanded.

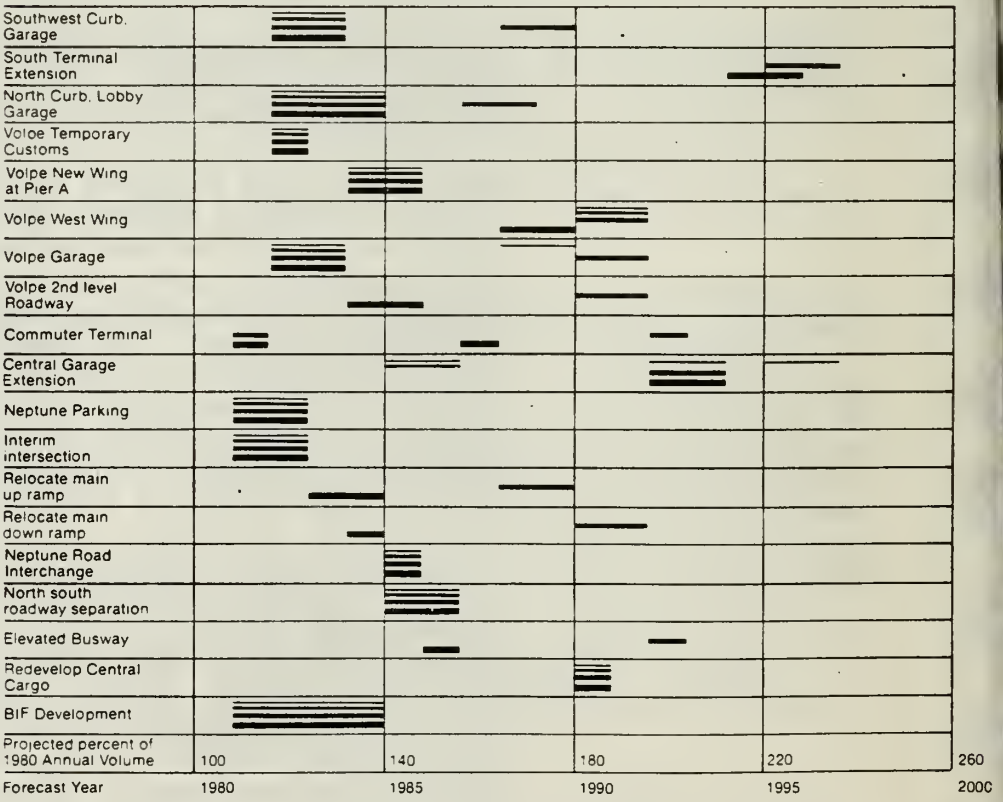
Strategies 1B and 2B reflect the past airport investment policy of investing in capacity to handle ten to twenty years of growth, as was the case for Volpe and South Terminals and Central Garage. One may argue for this strategy on the grounds that it avoids congestion and repeated disruption, and that availability of capacity encourages growth which is beneficial for Massport and for the regional economy as a whole.

Comparison of Staging Strategies

The sequences of actions called for by the four strategies are shown in Figure 11-11. Several actions have the same timing in all strategies because they respond to immediate facility needs that have been deemed of high priority. However, the extent of actions may differ between strategies even though they are scheduled at the same time, either because the development packages involve different options for certain facility improvements or because a project is broken into two phases in one of the strategies. Most projects are assumed to require two years of construction time regardless of scale.

Figure 11.11

Comparison of Staging Strategies



Southwest Terminal is addressed immediately because of curb congestion and insufficient parking. Strategies 1A and 1B include a vehicular overpass to the Central Garage. This would discourage a later shift to one of the Package 2 strategies involving an "air rights" garage here because both a garage and an overpass should be done in a single phase to avoid duplicating special staging problems (see Chapter 10). Strategy 2A breaks the terminal improvements into two phases; the second phase includes an additional curb extension and two-level access connections that are related to Terminal Roadway ramp relocation. Strategy 2B includes all improvements and the related Terminal Roadway modifications in the initial phase.

Staging implications: a basic choice of garage type must be made at an early phase, or garage improvements for this terminal must be deferred altogether. Modification of the Terminal Roadway ramps can be deferred, except in Strategy 2B.

South Terminal receives improvements only in Strategies 2A and 2B, which differ marginally in the timing of these improvements. Decisions on South Terminal can be deferred to the long-term in any strategy.

North Terminal requires improvements in the short-term to certain baggage facilities, ticket lobby, and curb. All strategies address these problems to some degree. Strategy 2A begins with the same work that is included in Strategies 1A and 1B, but it also includes a later phase in which curb and interior facilities are further expanded and an "air rights" garage is built. Strategy 2B consolidates all these improvements in a single early project.

Staging implications: the North Terminal improvements can be done flexibly in a number of ways as long as early improvements are consistent in design with later expansions.

Volpe Terminal involves several potential improvements and extensions. All strategies include immediate temporary customs space in order to defer major investments in permanent terminal space until other major airport projects such as Bird Island Flats and North Terminal improvements are close to completion.

All strategies include an expansion of the terminal on the Pier A side as an intial phase because this extension is compatible with any subsequent expansion option, because it defers the need for expansion into cargo and maintenance hangar sites, and because it provides greater flexibility for dual use as both domestic and international terminal. A later phase extension of the Volpe Terminal is included in all strategies at roughly the same forecast year.

All strategies include the early construction of a parking garage at Volpe to handle the overflows that are expected beginning in 1981. Strategies 1A and 2A split the garage construction into two phases separated by five years or more. Timing of the second phase varies slightly in order to distribute annual costs more evenly in the respective strategies.

A second level roadway serving Volpe is included in Strategies 2A and 2B. This improvement can be deferred until the second phase terminal expansion or included as part of the first phase. If no decision on whether to double-deck the roadway can be made during the first phase terminal expansion, the design of the new terminal wing should allow for conversion to a two-level terminal operation. Flexibility can be maintained at some increase in cost by including the necessary vertical circulation and allowing for second level entrances in the initial design; however, a decision on the roadway section is preferable by the first phase terminal expansion.

Staging implications: a number of staging strategies are possible for Volpe Terminal improvements. A decision on the final roadway configuration is desirable by the time of the first permanent expansion. Roadway improvements should take place in conjunction with one of the terminal expansion projects.

Commuter airline gates at Southwest Terminal are included in all strategies as programmed in the Massport capital budget. A later phase commuter terminal at the American Airlines hangar site is also included in Strategies 2A and 2B. The timing of this project is accelerated in Strategy 2B and deferred in Strategy 2A. Its staging affects the date at which the hangar must be displaced, although the hangar would be displaced by the expansion of international terminal apron in all strategies.

Central Garage is extended in Strategies 1A and 1B, an additional garage is constructed in the central zone in Strategies 2A and 2B. In Strategies 1A and 1B an early expansion occurs, since no "air rights" parking is provided at Southwest or North Terminals. Strategy 1A breaks the garage expansion into three phases, while Strategy 1B includes a single garage expansion of 3500 spaces for the entire forecast period. Strategies 2A and 2B include a single phase garage project in the mid-to-long term to accommodate growth beyond the capacity of the "air rights" garages and for rental ready-car parking.

Staging implications: Expansion of parking in the central zone can be staged more flexibly than "air rights" garage expansion at the terminals. Construction of parking in the central zone can serve both North and Southwest Terminals but less conveniently than parking closer to either terminal. Early construction of central zone parking will probably undercut plans to build "air rights" garages, so the location of initial parking expansion (excluding Volpe) will influence the North and Southwest Terminal plans.

Remote Parking as provided in the Massport capital budget is included in all strategies. Deferring this project would accelerate the need for parking and roadway improvements in the central area. Although it is not clear at what point in time such improvements could become essential.

North-South Service Road separation and Neptune Road interchange are staged in the same manner in all strategies. Only interim intersection improvements are provided immediately, offering relief until perhaps 1987. By this time a permanent solution for the separation of the Service Road and Terminal Roadways could be designed. Construction of a Neptune Road interchange to and from the north is not an essential part of the service road separation, but is a high priority project and is scheduled as soon as the uncertainty regarding cross-harbor roadways is expected to be resolved.

Terminal area roadway and busway improvements are included only in Strategies 2A and 2B. Relocation of the main up-ramp is related to Southwest Terminal improvements and must be staged in conjunction with them. Similarly, relocation of the main down-ramp is related to the second level roadway at Volpe, and should be staged in connection with that project. (Ramp relocations can also be added to Strategies 1A and 1B.) The elevated busway can be built as soon as both ramp relocations are complete.

Staging implications: these roadway improvements are not basic to the strategies and can be rescheduled, added, or eliminated as the case may be if the relationships described above are maintained.

Cargo area improvements are identical in all strategies. They include Bird Island Flats development as now included in the Massport capital budget and redevelopment of the Williams cargo area following completion and relatively full utilization of the BIF facilities, probably in the mid-term.

Changing Strategies

The comparisons of strategies made above give a general sense of the extent to which certain projects can be rescheduled, added, or eliminated, and the possibility of changing from one strategy to another. It is clearly not possible to shift from an early investment strategy to a deferred investment strategy after the first few years because substantial early investments are called for. It is possible to shift in the other direction, although certain projects require elaborate staging which one would be reluctant to repeat within a short interval for the sake of accelerating the second phase of the project.

It is relatively easy to shift from Strategy 1A to Strategy

Table 11.1 Staging Strategy 1A: Moderate Capital Investment, Deferred Resource Flow

orecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1981	1. BIF	-	-	$17.3	
	2. Interim N-S Intersection	150%	1986	0.8	
	3. Remote Parking Lot	-	-	0.5	
	Other MPA Cap. Budget Items	--	-	13.8	
	ANNUAL TOTAL			$32.4	$32.4
1982	BIF	-	-	6.0	
	Interim N-S Intersection	150%	1986	2.7	
	Remote Parking Lot	-	-	1.5	
	4. Temporary Customs Shelter	150%	1986	1.0	
	5. North Terminal Option 1	150%	1986[e]	3.7	
	6. Commuter Terminal @ SW	-		1.0	
	Other MPA Cap. Budget Items	-	-	6.4	
	7. SW Terminal Curb & Overpass	170%	1989[e]	2.0	
	8. Volpe Garage, Phase 1	170%	1989	5.1	
	ANNUAL TOTAL			$29.4	$31.8
1983	BIF	-	-	9.7	
	North Terminal Option 1	150%	1986[e]	3.7	
	Other MPA Cap. Budget Items	-	-	11.0	
	SW Terminal Curb & Overpass	170%	1989[e]	1.9	
	Volpe Garage, Phase 1	170%	1989	5.1	
	ANNUAL TOTAL			$31.4	$36.6
1984	BIF	-	-	2.0	
	North Terminal Option 1	150%	1986[e]	3.7	
	Other MPA Cap. Budget Items	-	-	14.7	
	9. Volpe East Wing	160%	1988[e]	14.0	
	ANNUAL TOTAL			$34.4	$43.3
1985	MPA Cap. Budget Items	-	-	13.1	
	10. N-S Roadway Separation	300%	2000+	5.5	
	11. Neptune Rd. Interchange	-	-	3.6	
	Volpe East Wing	160%	1988[e]	14.0	
	12. Central Garage Exten.	200%	1993	8.4	
	ANNUAL TOTAL			$44.6	$60.7

---

[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year. [e] Constrained by curb capacity.

Table 11.1 con. Staging Strategy 1A

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1986	N-S Roadway Separation	300%	2000+	$ 5.5	
	Central Garage Exten.	200%	1993	8.4	
	ANNUAL TOTAL			$13.9	$18.9
1988	13. Volpe Garage Phase 2	260%	2000	5.1	$ 8.7
1989	Volpe Garage Phase 2	260%	2000	5.1	$ 9.4
1990	14. Volpe West Wing	300%	2000+[e]	14.4	
	15. Central Cargo Redevel.	-	-	1.0	
	ANNUAL TOTAL			$15.4	$30.8
1991	Volpe West Wing	300%	2000+[e]	14.3	$30.9
1992	Central Garage Exten.	220%	1996	6.6	$15.4
1993	Central Garage Exten.	220%	1996	6.6	$16.6
1995	Central Garage Exten.	260%	2000	6.0	$17.6
1996	Central Garage Exten.	260%	2000	6.0	$19.0
TOTAL EXPENDITURE				$251.2	$372.1

---

[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year.

[e] Constrained by curb capacity.

Table 11.2 Staging Strategy 1B: Moderate Capital Investment, Early Resource Flow

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1981	1. BIF	-	-	$17.3	
	2. Interim N-S Intersection	150%	1986	0.8	
	3. Remote Parking Lot	-	-	0.5	
	Other MPA Cap. Budget Items	-	-	13.8	
	ANNUAL TOTAL			$32.4	$32.4
1982	BIF	-	-	6.0	
	Interim N-S Intersection	150%	1986	2.7	
	Remote Parking Lot	-	-	1.5	
	4. Temporary Customs Shelter	150%	1986	1.0	
	5. North Terminal Option 1	150%	1986[e]	3.7	
	6. Commuter Terminal @ SW	-	-	1.0	
	Other MPA Cap. Budget Items	-	-	6.4	
	7. SW Terminal Curb & Overpass	170%	1989[e]	2.0	
	8. Volpe Garage, both phases	160%	2000	10.2	
	ANNUAL TOTAL			$34.5	$37.3
1983	BIF	-	-	9.7	
	North Terminal Option 1	150%	1986[e]	3.7	
	Other MPA Cap. Budget Items	-	-	11.0	
	SW Terminal Curb & Overpass	170%	1989[e]	1.9	
	Volpe Garage, both phases	260%	2000	10.2	
	ANNUAL TOTAL			$36.5	$42.6
1984	BIF	-	-	2.0	
	North Terminal Option 1	150%	1986[e]	3.7	
	Other MPA Cap. Budget Items	-	-	14.7	
	9. Volpe East Wing	160%	1988[e]	14.0	
	ANNUAL TOTAL			$34.4	$43.3
1985	MPA Cap. Budget Items	-	-	13.1	
	10. N-S Roadway Separation	300%	2000+	5.5	
	11. Neptune Rd. Interchange	-	-	3.6	
	Volpe East Wing	160%	1988[e]	14.0	
	12. Central Garage Exten.	260%	2000	21.0	
	ANNUAL TOTAL				
				$57.2	$77.8

---

[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year.

[e] Constrained by curb capacity.

Table 11.2 con. Staging Strategy 1B

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1986	N-S Roadway Separation	300%	2000+	5.5	
	Central Garage Exten.	260%	2000	21.0	
	ANNUAL TOTAL			$26.5	$38.9
1990	13. Volpe West Wing	300%	2000+[e]	14.4	
	14. Central Cargo Redevel.	-	-	1.0	
	ANNUAL TOTAL			$15.3	$30.6
1991	Volpe West Wing	300%	2000+[e]	14.3	$30.9
TOTAL EXPENDITURE				$251.2	$333.8

---

[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year.

[e] Constrained by curb capacity.

Table 11.3 Staging Strategy 2A: Higher Capital Investment, Deferred Resource Flow

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1981	1. BIF			$17.3	
	2. Interim N-S Intersection	150%	1986	0.8	
	3. Remote Parking Lot	-	-	0.5	
	Other MPA Cap. Budget Items	-	-	13.8	
	ANNUAL TOTAL			$32.4	$32.4
1982	BIF	-	-	6.0	
	Interim N-S Intersection	150%	1986	2.7	
	Remote Parking Lot	-	-	1.5	
	4. Temporary Customs Shelter	150%	1986	1.0	
	5. North Terminal Option 1	150%	1986[e]	3.7	
	6. Commuter Terminal @ SW	-	-	1.0	
	Other MPA Cap. Budget Items	-	-	6.4	
	7. SW Terminal Curb & Garage	170%	1989[e]	9.7	
	8. Volpe Garage, Phase 1	170%	1989	5.1	
	ANNUAL TOTAL			$37.1	$40.1
1983	BIF	-	-	9.7	
	North Terminal Option 1	150%	1986[e]	3.7	
	Other MPA Cap. Budget Items	-	-	11.0	
	SW Terminal Curb & Garage	170%	1989[e]	9.7	
	Volpe Garage, Phase 1	170%	1989	5.1	
	ANNUAL TOTAL			$39.2	$45.7
1984	BIF	-	-	2.0	
	North Terminal Option 1	150%	1986[e]	3.7	
	Other MPA Cap. Budget Items	-	-	14.7	
	9. Volpe East Wing	160%	1987[e]	16.1	
	ANNUAL TOTAL	-	-	$36.4	$46.0
1985	MPA Cap. Budget Items	-	-	13.1	
	10. N-S Roadway Separation	300%	2000+	17.5	
	11. Neptune Rd. Interchange	-	-	4.0	
	Volpe East Wing	160%	1987[e]	16.1	
	ANNUAL TOTAL			$50.7	$69.0

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[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year.

[e] Constrained by curb capacity.

Table 11.3 con. Staging Strategy 2A

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1986	N-S Roadway Separation	300%	2000+	$ 5.5	$ 8.1
1987	12. North Terminal Option 2	250%	1999[e]	14.2	$22.5
1988	North Terminal Option 2	250%	1999[e]	14.2	
	13. Relocate Main Up-Ramp	-	-	2.3	
	14. SW Terminal Access Mod.	240%	1998[e]	2.3	
	ANNUAL TOTAL			$18.7	$32.0
1989	Relocate Main Up-Ramp	-	-	2.3	
	SW Terminal Access Mod.	240%	1998[e]	2.3	
	ANNUAL TOTAL			$ 4.6	$ 8.5
1990	15. Central Cargo Redevelopment	-	-	1.0	
	16. Relocate Main Down-Ramp	-	-	1.5	
	17. Volpe West Wing	350%	2000+	17.3	
	18. Volpe Garage Phase 2	260%	2000+	5.1	
	19. Volpe 2nd Level Roadway	-	-	7.3	
	ANNUAL TOTAL			$32.2	$64.4
1991	Relocate Main Down-Ramp	-	-	1.5	
	Volpe West Wing	350%	2000+	17.2	
	Volpe Garage Phase 2	260%	2000+	5.1	
	Volpe 2nd Level Roadway	-	-	7.2	
	ANNUAL TOTAL			$31.0	$66.9
1992	20. Commuter Terminal	-	-	10.0	
	21. Extend Central Garage	260%	2000	9.0	
	22. Elevated Busway	-	-	1.8	
	ANNUAL TOTAL			$20.8	$48.5
1993	Extend Central Garage	260%	2000	9.0	$22.7
1995	23. Extend South Terminal	290%	2000+	13.3	$39.1
1996	Extend South Terminal	290%	2000+	13.2	$41.9
TOTAL EXPENDITURE				$353.3	$587.8

---

[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year. [e] Constrained by curb capacity. [f] Constrained by gate capacity.

Table 11.4 Staging Strategy 2B: Higher Capital Investment, Early Resource Flow

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1981	1. BIF	-	-	$17.3	
	2. Interim N-S Intersection	150%	1986	0.8	
	3. Remote Parking Lot	-	-	0.5	
	Other MPA Cap. Budget Items	-	-	13.8	
	ANNUAL TOTAL			$32.4	$32.4
1982	BIF	-	-	6.0	
	Interim N-S Intersection	150%	1986	2.7	
	Remote Parking Lot	-	-	1.5	
	4. Temporary Customs Shelter	150%	1986	1.0	
	5. North Terminal Option 2	250%	1999[e]	13.1	
	6. Commuter Terminal @ SW	-	-	1.0	
	Other MPA Budget Items	-	-	6.4	
	7. SW Terminal Curb & Garage	240%	1998[e]	12.0	
	8. Volpe Garage, both phases	260%	2000	10.2	
	ANNUAL TOTAL			$53.9	$58.2
1983	BIF	-	-	9.7	
	North Terminal Option 2	250%	1999[e]	13.1	
	Other MPA Cap. Budget Items	-	-	11.0	
	9. Relocate Main Up-Ramp	-	-	4.6	
	SW Terminal Curb & Garage	240%	1998[e]	12.0	
	Volpe Garage	260%	2000	10.2	
	ANNUAL TOTAL			$60.6	$70.7
1984	BIF	-	-	2.0	
	North Terminal Option 2	250%	1999[e]	13.1	
	Other MPA Cap. Budget Items	-	-	14.7	
	10. Volpe East Wing	190%	1992[f]	16.1	
	11. Volpe 2nd Level Roadway	-	-	7.9	
	12. Relocate Main Down-Ramp	-	-	3.0	
	ANNUAL TOTAL			$56.8	$71.6
1985	MPA Cap. Budget Items	-	-	13.1	
	13. N-S Roadway Separation	300%	2000+	17.5	
	14. Neptune Rd. Interchange	-	-	4.0	
	Volpe East Wing	190%	1992	16.1	
	Volpe 2nd Level Roadway	-	-	7.9	
	ANNUAL TOTAL			$58.6	$79.7

[a] Calendar year. For 1981-85, MPA Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but exluding relocation and acquisition costs.

[d] Escalated at 8% per year. [e] Constrained by curb capacity.

Table 11.4 con. Staging Strategy 2B

Forecast Year[a]	Project	New Threshold		Estimated Cost ($ Million)	
		% of 1980	Forecast Year[b]	Constant $[c]	Escalated[d]
1986	N-S Roadway Separation	300%	2000+	$ 5.5	
	15. Elevated Busway	-	-	1.8	
	ANNUAL TOTAL			$ 7.3	$10.7
1987	16. Commuter Terminal	-	-	10.0	$15.9
1988	17. Volpe West Wing	350%	2000+[f]	16.6	$28.4
1989	Volpe West Wing	350%	2000+[f]	16.6	$30.7
1990	18. Central Cargo Redevel.	-	-	1.0	$ 1.9
1992	19. Extend Central Garage	260%	2000	9.0	$21.0
1993	Extend Central garage	260%	2000	9.0	$22.7
1994	20. Extend South Terminal	290%	2000+	13.3	$36.0
1995	Extend South Terminal	290%	2000+	13.2	$38.8
TOTAL EXPENDITURE				$358.3	$518.7

---

[a] Calendar year. For 1981-85, MP Capital budget items for FY 1982-86 are included.

[b] Based on forecasts; see text.

[c] 1981 dollars, including design costs but excluding relocation and acquisition costs.

[d] Escalated at 8% per year.

[f] Constrained by gate capacity.

2A, except for the Southwest Terminal garage option, until the initial Central Garage extension has been made. It is more difficult to shift from Strategy 1B to Strategy 2A after the garage expansion because most of the future parking program will have been satisfied in the early phase. Changing from Strategy 2A to one of the strategies involving the lower investment development package can be done only partially and to a decreasing extent as Southwest Terminal, the Volpe Roadway, the Terminal Roadway improvements, and the second phase North Terminal improvements are constructed. If the option to switch strategies must be maintained for the first few years, the Southwest Terminal garage improvement might be deferred. Changing from Strategy 2B to another strategy becomes impossible almost immediately because of the early improvements to Southwest and North Terminals.

Conclusions

The primary criteria for choosing a development strategy should be the anticipated availability of funds and the general posture that the Authority chooses regarding accelerated versus deferred investment involving economic factors such as inflation, cost of capital and the bond market, etc. Generally, deferred investment strategies, such as Strategies 1A and 2A can be altered more easily than accelerated strategies.

The strategies and development packages explored in this report are not intended to exhaust the possibilities for prudent investment. Massport can change strategies without regard to the "purity" of the plan which results: a major conclusion of this Land Use Master Plan study is that options for action are to a great extent independent and can be staged in several ways subject to the specific relationships described in this chapter and Chapter 10.

It should be stressed again that thresholds are merely mileposts on a continuum of increasing congestion; facilities will continue to function when they are beyond their thresholds, but with reduced convenience. Interim actions such as curb policing and overflow parking lots (which may be needed during construction in any case) can be used to keep facilities operating if improvements must be deferred.

It should also be emphasized that growth is unlikely to follow a steady course even if the long-term forecasts are accurate. This means that peak hour activity (in particular) should be monitored and the chosen strategy updated each year as described in Chapter 2.

Acknowledgements

This report has been prepared for the Massachusetts Port Authority, with overall direction, coordination and assistance from:

David W. Davis, Executive Director
Norman Faramelli, Director of Planning
Catherine Donaher, Former Director of Planning
William C. Coleman, Director of Aviation
David Weiner, Director of Engineering
Joseph Brevard, Chief Planner-Aviation Planning

Several Massport staff members have been generous with their time, expertise and concern:

Edward Baldwin
Joel Bornstein
Albert V. Bratt, Jr.
Heather Conover
John Davis
James Derba
John Fitzgerald
Barbara Gard
Andrew C. Hyde
Richard Marchi
Peter Munkenbeck
Georgia Pappas
Karen Pearson
Frank Penders
Carol Saffran
Peter Sheinfeld
Paul Showstead
Edward Student
Mary Ellen Sullivan
Karen Waite

Many individuals, firms, and agencies have also provided valuable assistance through one or more of the following groups:

Federal Aviation Administration-New England Region
East Boston Land Use Council
Logan Airport Users Committee
Boston Airline Committee
Massachusetts Aeronautics Commission

Special thanks to the Massachusetts Port Authority Board of Directors.

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SVERDRUP AND PARCEL & ASSOCIATES, INC.
Airport and Civil Engineers

BRYANT ASSOCIATES, INC.
Traffic Engineers and Surveyors

RYAN ELLIOT APPRAISAL AND CONSULTING, INC.
Real Estate Consultants

RALPH BURKE ASSOCIATES
Management Consultants

CAMBRIDGE ACOUSTICAL ASSOCIATES
Noise Consultants

PHOTOGRAPHS
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